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Mr. Stefansson is known for his repeated journeys in the Arctic and especially for his work as leader of the Canadian Arctic Expedition, 1913–1918, of which he has recently published an account under the title of "The Friendly Arctic" (reviewed in this number of the *Geographical Review*). In recognition of "the unique interest and importance" of this book Mr. Stefansson has been awarded the Grant Squires prize of the National Geographic Society. He is also the author of another admirable volume "My Life with the Eskimo" (1913), and he has contributed several articles to the *Geographical Review*.

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ESKIMO ART *

By DIAMOND JENNESS
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One of the most fascinating problems in ethnological study is the presence of a highly developed art among races that are in a very low stage of culture. Our paleolithic ancestors in western Europe covered the walls of their cave dwellings with lifelike paintings of the men and animals around them; and in South Africa the primitive Bushmen adorned their rock shelters with equally realistic figures in black and white. So, too, the Eskimos of the Arctic, using only flakes of flint or treasured scraps of iron, carved and engraved on bone and ivory with a skill that excited the admiration of every early explorer. This graphic art was universal among the Eskimos, extending from Alaska on the one side to Greenland on the other; it dates from prehistoric times until the present day. Every large museum in Europe and America is filled with excellent examples of it. There are not only carvings of men and animals, free and in relief, but exquisite engravings, from elaborate representations of hunting and domestic scenes down to simple geometrical patterns. It is true that there are great differences in the artistic ability of different tribes. In southern Alaska it is almost the exception to find an article of bone or ivory without decoration of some kind; even so utilitarian and commonplace an object as a bucket handle often has a row of seals or other animals carved in relief on its surface. Farther east, in Coronation Gulf, the only designs are a few incised lines, even though the beautifully polished bone needle cases and quiver handles would naturally lend themselves to more elaborate ornamentation. Sculpture reappears, however, in Hudson Bay; and in East Greenland, among one of the most barbarous and impoverished of all the Eskimo tribes, it reached almost the same high level as in Alaska. Every branch of the Eskimo race, indeed, seems to possess marked artistic ability, although in some places, owing partly to unfavorable economic conditions, the talent remained more latent than it did elsewhere.

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Influence of European Civilization

This highly developed art of the Eskimos, far from being destroyed by contact with European civilization, as happened so often elsewhere, received a certain stimulus. Thus there are strong grounds for believing that the exceptional development of sculpture and engraving among the Alaskan Eskimos was due to contact with the Indian tribes on the northwest coast and with Russian civilization filtering in through Asia. In more recent times the settlement of Alaska by Americans has led to the creation of a regular industry in ivory work; and though most of the carving and engraving that is now being produced and sold to the outside world is of a much inferior quality, despite the use of modern tools and machinery, now and again some specimen does really attain to, if not actually surpass, the work of previous generations. The same thing has happened, although to a less degree, on the Hudson Bay side of the continent and again in Greenland.

Such unusual artistic talent among a primitive nomadic race of hunters could not fail to attract the notice of scientists, and various writers, Hoffman,[1] Boas,[2] and Thalbitzer,[3] have discussed their work in bone and ivory. One development from it, however, the pencil sketches of the Eskimos, has been altogether neglected in English-speaking countries up to the present, although one or two explorers, notably Peary and MacMillan, have published a few examples of it. The use of pencil and paper is of course quite modern, but it is merely an improvement on the old Eskimo custom of using native graphite for drawing on wood and skin. The ease and freedom of a pencil, however, has made these paper sketches a popular pastime, and amateur artists are everywhere recording their impressions and adventures in notebooks, on the margins of old magazines, and on any scrap of paper that they can find. In Danish Greenland the Eskimos have long run a printing press and published a journal devoted almost entirely to Eskimo topics and illustrated with sketches by native artists. In fact, wherever you wander, if you give a notebook and pencil to an Eskimo, whether he can write or not, he is almost certain to fill the book with drawings of men and animals, hunting scenes, and scenes of social life.

Naturally the average native, even with the pencil, is still bound by his old tradition; his drawings show the same want of perspective, the same lack of detail, and the same conventionality as his engravings and carvings. Nevertheless, under the influence of new ideas inspired by the European sketches which the Eskimos are fond of copying, an artist does occasionally rise above the general level and produce a few drawings that display real imagination and promise. It is not that he departs from the old subjects; his talent is still limited to the delineation of hunting scenes and social life

[1] W. J. Hoffman: The Graphic Art of the Eskimos, *Rept. U. S. Natl. Museum for the Year Ending June 30, 1895*, pp. 739–968.

[2] Franz Boas: The Central Eskimo, *6th Ann. Rept. Bur. of Amer. Ethnology for 1884–85*, pp. 399–669; *idem*: Decorative Designs of Alaskan Needlecases, *Proc. U. S. Natl. Museum*, Vol. 34, Washington, D. C., 1908, pp. 321–344.

[3] William Thalbitzer: The Ammassalik Eskimo, *Meddelelser om Grønland*, Vol. 39.

as he knows it; but he develops an impressionistic idea of the scene as a totality, replete with detail and environment, together with a vague notion of perspective and a truer sense of proportion. It does not require much imagination to believe that if one of these Eskimo artists could only receive a little training he might produce something that would be worth hanging in our salons alongside the pen-and-ink sketches from Japan or the drawings of our own impressionistic schools.

Examples of Eskimo Art from Three Different Regions

This new development in Eskimo art aroused the interest of the American Geographical Society, who gathered a number of examples of it from two well-known explorers, Mr. D. B. MacMillan and Mr. R. J. Flaherty. The drawings supplied by Mr. MacMillan were made by Kakotcheea, a nineteen-year old Eskimo of Smith Sound in northern Greenland, where Mr. MacMillan established a base for his explorations. The Smith Sound Eskimos were discovered by Sir John Ross in 1818; since that date they have been visited by many explorers and whalers, some of whom, for example Kane and Peary, remained for two or more years in their midst. Mr. Flaherty's sketches are from an altogether different region. They are the compositions of Wetalltok, an Eskimo from the Great Whale seaboard on the eastern coast of Hudson Bay. Wetalltok had been in the service of the Hudson's Bay Company for about fifteen years and beside these drawings contributed a remarkably accurate sketch map of the Belcher Islands,[4] a map that is itself one of the best examples of the cartographic skill for which the Eskimos have long been famous.

To the sketches from these two regions I have added a few that were drawn for me in the winter of 1913–1914 by an Eskimo from Cape Prince of Wales in northern Alaska. This Eskimo, named Ugiagnak, was a middle-aged man who could neither read nor write, although he had been in contact with white men all his life. The natives of northern Alaska were less advanced in graphic art than those of southern Alaska but far more so than either the Hudson Bay Eskimos or those of Smith Sound. Our three artists, then, from three different regions, are interesting on two quite distinct grounds. In the first place the identity of subject matter in all three bears witness to the remarkable uniformity of Eskimo culture despite the enormous range of territory over which it extends. In the second place, the differences in technique of the three men give us an indication of the direction which this graphic art may take among the Eskimos, if ever they are afforded the opportunity of developing it.

Hunting Scenes

Figures 1–5 illustrate the Eskimo method of hunting the walrus. The season for walrus hunting is the late summer, when the sea is covered with

[4] Published in the *Geographical Review*, Vol. 5, 1918, p. 440.

FIG. 1

FIG. 2

FIG. 3

FIG. 1—Harpooning walrus on the ice. By Ugiagnak, an Eskimo of northern Alaska. This and the other drawings by Ugiagnak are reproduced the size of the original, the drawings by Kakotcheea and Wetalltok are slightly reduced.

FIG. 2—Harpooning walrus in the water. By Kakotcheea, an Eskimo of Smith Sound.

FIG. 3—Kayaks towing to shore a dead walrus to which are fastened two sealskin floats to keep the body on the surface. By Kakotcheea.

loose cakes of floating ice that offer very little obstruction to navigation in small boats. The animals are harpooned either while swimming in the water (Fig. 2), or as they bask in the sunshine on some floating ice cake (Fig. 1); the *coup de grâce* is now usually given with the rifle. The carcase is then towed to shore (Figs. 3 and 4) or to the nearest ice floe and immediately cut up (Fig. 5). In Alaska, as we see from Figure 1, the hunter makes use of the large skin boat called umiak, which resembles in shape our whaleboat. Among most Eskimo tribes this is regarded as the woman's boat and is used only for transportation; the hunter's vessel is the smaller one-man kayak, as shown in Figures 2 and 3. But in Alaska the umiak is used for both whale and walrus hunting, the women serving in the latter pursuit as paddlers only. The middle paddler in Figure 1 is plainly a woman, for her hair is tied in a knot on the back of her head.

These five sketches taken together depict a scene which might occur any day in the month of August either off the northwest coast of Alaska or in Hudson Bay or on the coast of Greenland. But there are noticeable differences in the artistic value of the sketches. Figure 1, from Alaska, shows all the hardness and conventionality of the etchings on ivory which are so common in this region; it might easily have been one of these etchings transferred to paper. The artist's imagination is confined to a silhouette outline of the essential features of his subject. There are the two walruses on an ice cake, the boat, the paddlers, the harpooner, and his weapon, every one of which is absolutely essential to the interpretation of the drawing. Beyond this there is nothing, not even an indication of the sea. It is a picture story, a graphic description of an event the details of which are left to the imagination. Conventional as it is, however, it is far from being a mere pictograph; the startled attitudes of the walruses and the vigor with which the women are driving their paddles into the water give character and realism to the drawing that no mere pictograph can ever possess. Figure 4, from Hudson Bay, shows the same limitations, the same silhouette outline and lack of all atmosphere, although the artist has tried to convey a sense of the environment by adding dogs and driftwood. But in Figure 5, from the same region, a new feature is introduced, a dawning sense of perspective. The artist is not quite sure of it, and in consequence his landscape seems divorced from his main subject, the cutting up of the walrus; but he has taken a great step forward and achieved something which his ancestors, for all their skill in carving and etching, never dreamed of. The event is no longer taken out of its setting, but the two are combined into one artistic whole. He has accomplished this, too, without any loss of the old vigor; so that, crude and imperfect as his sketch undoubtedly is, it yet shows possibilities of great development. We can see a growth in Figures 2 and 3, from Smith Sound. In these the artist has a much clearer vision of the details and surroundings of his theme. His kayakers are traveling over a sea full of ripples and reflections. Figure 2 even adds a new feature, the use of shading to give depth and distance. This Smith Sound

FIG. 4

FIG. 5

FIG. 6

FIG. 7

FIG. 4—Dragging a walrus on to the beach. By Wetalltok, an Eskimo of Hudson Bay.
FIG. 5—Skinning a walrus. By Wetalltok.
FIG. 6—Hunter stalking a seal. By Ugiagnak.
FIG. 7—Going after seal (or walrus) in Kayaks. By Wetalltok.

artist has certainly traveled far beyond the Alaskan artist of Figure 1, or the engravers on bone and ivory.

Two methods of sealing, both of them common in every part of the Eskimo world, are depicted in Figures 6 and 7. In Figure 6, by the Alaskan artist, the hunter is represented as crawling stealthily over the surface of the ice towards his quarry. This is a method adopted in the spring of the year, when the seals are basking in the sunshine outside their holes. In Figure 7, by Wetalltok, the Hudson Bay Eskimo, the summer method is

FIG. 8—Hunting caribou. By Wetalltok.

FIG. 9—Caribou scenting hunters. By Kakotcheea.

represented. The seals (and walruses) are then either basking on floating ice cakes or swimming in the water around them. The hunters sometimes harpoon them from their kayaks; more often they paddle over to a small ice cake near by, draw up their kayaks, and fasten the end of the harpoon line round a hummock of ice. They then cautiously work their raft towards the seals and drive in their harpoons. The animals dive but are prevented from escaping by the line fastened to the hummock. This method of hunting has survived even the use of rifles, for in the late summer seals lose much of the blubber that gives them their buoyancy and sink as soon as they are killed.

This drawing of Wetalltok illustrates the lack of proportion that is so common in Eskimo drawings. Almost invariably, in depicting men and animals, the head is made out of scale with the rest of the figure; in the present case the seals and the ice cake are much too large. Moreover, the artist, although learning the use of perspective, has not been able to free himself from the old conventionalism. His ice cake is purely a conven-

FIG. 10

FIG. 11

FIG. 12

FIG. 10—Muskox. By Kakotcheea.

FIG. 11—Hunting the polar bear. By Ugiagnak.

FIG. 12—Closing in on a polar bear with a team of dogs. It is the custom upon sighting a bear to release the dogs in order to hold the bear at bay until the driver arrives with the rifle or lance to despatch it. By Kakotcheea.

tional one, and his seals have the traditional impersonality. His sketches of caribou in Figure 8 are far superior. They are depicted in different attitudes, all of them true to life. One is quietly grazing, another walking slowly towards it, a third lying on its side. Near the two hunters, who are armed with the old-fashioned bows and arrows, the caribou have leaped to their feet, startled; and one is running away. Over on the right is the hunters' sled with the dogs lying down in front. Excellent as the individual figures are, there is no background of any kind; they are simply an artist's studies.

Kakotcheea's sketch (Fig. 9) is quite different; it has an impressionistic touch quite new in Eskimo art. There is less variety in the attitudes of the caribou, and the horns are a little too uniform and conventional; but they are true to life, and the background is just sufficiently pronounced to give a sense of realism. It is a curious thing, indeed, that the Eskimos have always been more successful in portraying caribou than anything else; the proportions are more accurate, and the action is more vivid. No doubt it is partly due to the fact that the dependence of the Canadian and Greenland Eskimos upon the caribou for a large portion of their food supply has made

FIG. 13—Shooting geese. By Wetalltok.

them keen students of its actions and attitudes, and this has reflected itself in their art. The same reason would apply also to Alaska, although now the domesticated reindeer has taken the place of the wild caribou, which has been almost exterminated in that region. Yet this explanation alone can hardly be sufficient, otherwise we should expect the same excellence in the representations of the musk ox, which in Smith Sound is almost as important to the Eskimos as the caribou; but, as Figure 10 will illustrate, their drawings of musk oxen show much less fidelity to life. The main reason must surely be that the caribou, so universal once throughout Arctic America and the neighboring portion of Asia and so indispensable to the Eskimos for food and clothing, has been a favorite subject for representation from the very dawn of their art; whereas the musk ox with its more restricted range and lesser economic importance has a far shorter tradition behind it, and artists have not developed the same technique in its portrayal.

FIG. 14—Scene in a dance house. By Ugiagnak.

Figures 11 and 12 illustrate the hunting of the polar bear, which is common almost everywhere in circumpolar regions. One method is to stalk up cautiously behind ice hummocks and to shoot at close range, formerly with bow and arrow, as in Figure 11, now with the rifle. The polar bear is rather a timid animal until it is brought to bay; even then, in Eskimo estimation, it is less formidable than the Barren Ground grizzly. The method of hunting shown in Figure 12, bringing it to bay with dogs, is more certain of success. During the summer of 1915 a party of Eskimos with whom I was traveling on Victoria Island came upon a polar bear and its cub, the latter nearly full-grown, quietly swimming across a lake. They fled at sight of us; and the Eskimos, loosing the dogs, pursued them on foot. The cub was overtaken after a stiff chase of about three miles, the mother two miles farther on; and both were shot with a rifle. Before rifles came into use, however, the Eskimos used to surround the bear and stab it to death with harpoons and lances, although often one or more of their number was killed or severely wounded.

The last of the hunting scenes in this collection, Figure 13, is also in some ways the most remarkable. Two Eskimos clad in white overshirts, or "dickies," are shooting at a flock of geese flying overhead on their annual migration. Nowhere in Eskimo art have I seen anything approaching the excellence of these birds both in form and detail. The careful shading of the underparts alone would attest European influence. There is still a little stiffness, especially in the foremost bird, but the general effect is remarkably realistic. One can hardly credit the production of this sketch and that of Figure 7 to the same artist.

Social Scenes

Hunting scenes and game animals are by far the commonest subjects of Eskimo art. However, we do occasionally find, even on bone and ivory, scenes of social life such as that given in Figure 14, where the artist has taken as his subject a

dance held inside one of the wooden houses, half buried beneath the snow, in which the Eskimos of Alaska pass the winter. The mingling of ancient and modern elements in their present-day culture comes out in the juxta-position of a skylight of seal intestines sewn together and a chimney belching forth smoke from a sheet-iron stove inside. The figures of the three drummers seated at the back of the room are instinct with vivacity and the *joie de danse*. The prancing attitude of the plume-bedecked man, and the swaying motion of the woman, well illustrate the difference in the methods of dancing of the two sexes. The last figure on the right has a religious significance. It represents a shaman or medicine man inspired by his guardian spirit, the walrus, and simulating the form of that animal by the two tusks that protrude magically from his mouth. The shaman among the Eskimos was a public functionary who gave most of his performances in the dance house. He claimed to control certain of the spirits which were believed to govern the universe, spirits of animals and of mythical beings through which he could regulate the supply of game. One of them is shown in this illustration flying unseen through the air above the dance house in search of caribou, and trailing a large stone with which to kill his enemies. Many other miracles are recorded of them, and even today the natives of Alaska firmly believe in their power, though shamanism is now dead and all the Eskimos in this region have embraced Christianity.

FIG. 15—Eskimo summer camp. By Wetalltok.

SUMMER ENCAMPMENT

Summer encampments are becoming rather a popular subject for representation among the Eskimos, although comparatively rare in the old engravings. We have two such drawings in this collection, Figures 15 and 16, both by the same Hudson Bay native, Wetalltok. In the latter he has deviated from the old traditional art only in one figure, that of the man peering inside the tent, which shows a little more imagination than is usual in etchings on bone and ivory. The tents, the dogs, and the man standing are as conventional as ever. Figure 15, on the contrary, belongs to the new age that recognizes perspec-

tive and shading without as yet mastering either. It is a fair example of the ability of the average Eskimo to depict a landscape. The artist has chosen for his subject an everyday scene in summer, when the Eskimos of both Hudson Bay and Greenland pitch their tents on the seashore and with their kayaks hunt the seals in the open waters of the bays and fiords. Figure 17, by the same Eskimo, Wetalltok, shows one of their methods of traveling at this period.

Summer and Winter Travel

As long as the Eskimos remain on the shore they can move from one sealing ground to another in their large skin boats. But summer is also the season for fishing and caribou hunting; the salmon are now migrating

Fig. 16—Eskimo tents. By Wetalltok.

Fig. 17—Eskimos traveling with packs in summer. By Wetalltok.

up the creeks and rivers to spawn, and the caribou have shed their heavy winter coats and are now covered with short-haired fur invaluable for lighter clothing. The rivers are mostly too rapid and too shoal for boats, and moreover the caribou are grazing on the open plains or on the slopes of the hills. So the Eskimo loads all the necessary equipment on his back or on the backs of his dogs and moves away inland. The man always leads on these migrations, for at any moment game may be sighted and he may have to drop his pack and go off hunting; the wife and children follow him, carrying the tent and the household utensils. An Eskimo thinks nothing of traveling 14 or 15 miles with a load of 100 pounds on his back and at the end of the day spending four or five hours in hunting. The women carry almost equal

loads, and the children in proportion to their size, while a dog's pack varies from 20 to 50 pounds. Traveling is somewhat easier at other seasons of the year, for the Eskimo can then employ his sled. In Figure 18 our Smith Sound artist has contributed a sketch that partly illustrates this method. It is an impressionistic sketch of a team of dogs dragging a sled, seen from the viewpoint of the driver. Europeans have introduced the custom of driving dogs like horses, singly or in pairs one behind the other, with the most intelligent as the leader; but in many places the Eskimos still cling to the use of a separate trace for each dog, as in the illustration. There are many inconveniences in the method, but it has one advantage; the dogs can all be released simultaneously at the sight of game by simply casting off their traces from the one toggle which holds them.

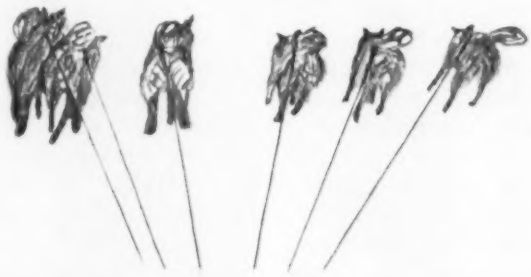

FIG. 18—Dog team viewed from sled. By Kakotcheea.

This little sketch of Kakotcheea is in some ways the most remarkable in the whole collection. In the first place the artistic conception of representing a team of dogs from behind is altogether foreign to ordinary Eskimo art. It is a photographic impression of a momentary scene, not a more or less symbolic representation of a method of traveling, as the old engravers on ivory would have made it. Again, the accuracy with which the dogs are delineated, each with some slight difference, is amazing. These panting animals tugging at their traces are totally unlike the rather lifeless, misshapen creatures of Wetalltok's creation (Figure 17). The one man might seem to have focussed an actual scene on his retina, the other merely conjured up a typical one; but I suspect that the Smith Sound native has simply copied an explorer's photograph, and that the striking individuality of his sketch is due to that source alone.

THE DEVELOPMENT OF ESKIMO ART

From these drawings taken from three different regions, Alaska, Hudson Bay, and Smith Sound, we can gather some idea of the course along which Eskimo art has been developing during the last half-century. The Alaska drawings faithfully follow the old tradition; they might have been made

on bone or on ivory a hundred years ago. The art is a purely conventional one, everything being represented in silhouette and all details being omitted that are not absolutely essential to the interpretation of the drawings. Its greatest merit lies in the fidelity to life of the figures of men and animals and the vividness with which action is portrayed. But it is essentially a "shadow" art, where figures are merely reflected as on a screen and lack both background and depth; it assumes too readily a symbolic aspect and loses touch with reality altogether—a fate that has overtaken it in many of the ivory etchings, although our artist here has avoided it. The Hudson Bay native is in the awakening stage. He has learned to sense vaguely the crowded world of color and environment and so tends to give more detail to his drawings. Moreover, he has a growing feeling for perspective, of the relation of subject to the surrounding landscape. But the defects in proportion and the stiffness and conventionality of many of his figures mark him as being in the main a follower of the older tradition. The Smith Sound artist, on the other hand, clearly belongs to the new generation. He takes an impressionistic view of his subject, not the symbolic one of the earlier artists. In technique he has learned the principles of perspective to give distance and of shading to give depth. There is a recognition, too, of the necessity for atmosphere in a picture to help out its meaning. He has not mastered completely any one of these things; his sketches are still the productions of a mere novice in the art, but of a novice who would show promise of much higher fulfilment were it not for one great weakness—a weakness that no Eskimo artist to my knowledge has yet tried to overcome—a disregard of individuality that robs a sketch of half its character.

In conclusion one word of warning may be given. Because our Alaskan representative has adhered most closely to the old traditional art of his race, and the Smith Sound one has departed most from it, it must not be assumed that Alaskan artists as a whole are very conservative, whereas those in Smith Sound are more progressive. On the contrary I have seen sketches from both Alaska and the Mackenzie River delta that show as great an advance over the old etchings on ivory as any of the illustrations given in this article. The psychological law that "similar stimuli applied to similar subjects produce similar reactions" is really quite verified, and the type of art common to all branches of the Eskimo race is developing everywhere along the same general lines under the influence of European culture.

THE GEOGRAPHICAL NAMES USED BY THE INDIANS OF THE PACIFIC COAST*

By T. T. WATERMAN
Museum of the American Indian, Heye Foundation

Some time ago my attention was attracted to the matter of the names given by the Indians to various places, especially in the region of the Pacific coast from Puget Sound to northern California. Within these limits I have had opportunity to talk with several hundred natives, and the total number of names obtained from them amounts to many thousands. Whenever sojourning among a tribe, I have endeavored to get every geographical name they knew, the "meaning" of it, and the exact spot on the map to which it referred, the last-named labor being facilitated by the excellent topographic maps of the U. S. Geological Survey and the charts of the U. S. Coast and Geodetic Survey.

The American public evinces a good deal of interest in this matter of Indian names. I have during late years received many a request for Indian words to be employed as the names for estates, for motor boats, for bungalows, and beach cottages. In some cases the old Indian names for places have become famous, having been attached by accident to some subsequently notable site. Where this has happened, as, for example, where a great city or a world-famous mountain boasts an Indian name, the *meaning* of the name becomes a matter of interest to thousands of people. It is a misfortune that some of the old names have become matters of dispute, owing largely to the fact that inquiries were not made prior to the passing of the Indians. Thus the meaning of "Manhattan," which is an Indian name, has given rise to a good deal of theorizing and to some conflict of authority and remains a matter of genuine uncertainty. The question of the original name of Mt. Rainier, in the state of Washington, suggests itself also in this connection. This magnificent peak towers up in the neighborhood of two rival cities, one of which has advanced the contention that the original Indian name of the peak was "Tacoma" and that the mountain name should be changed accordingly. The whole question as to whether its name was Tacoma and, if so, what the meaning of Tacoma originally was, is still a matter of lively interest to the communities involved. I have been told that a hundred thousand dollars has been expended, directly and indirectly, in the campaign to have the name changed; largely, of course, on printing and publicity. The whole matter unfortunately was entered into in a partisan and not in a disinterested spirit.

* The expense of the journeys on which Indian place names were obtained has been borne by several institutions, among them the University of California, the University of Washington, and the Museum of the American Indian, Heye Foundation. To all of them acknowledgments are due.

In my own work such mooted points have not arisen. My purpose has been to collect as many names as possible in each area investigated, meanwhile listening to the folklore that associates itself with these old places and acquainting myself with the life of the people. By making a complete collection in each area it becomes possible to compare one tribe with another, as regards geographical usages. I now propose to say something, therefore, about the sort of names that West Coast Indians give to places and about how these tribes compare with one another and with ourselves in this respect.

Difficulties in Determining the Origin of Place Names in General

Certain difficulties thrust themselves forward in work of this character, and it is desirable that they be explained at the outset. It is in every case possible to find exactly the spot to which a name applies. There is no limit to the accuracy possible in this respect except that of time and money. The *meaning* of Indian names, however, must remain in many cases a matter of some uncertainty. There is a probability of error which cannot be precisely measured. This is true, for that matter, as regards the place names of all countries and all peoples. Place names often come down from a hoary antiquity, and the original meaning is often not known to the latter-day people who live in the region. I can illustrate this point by asking you to imagine going out as a stranger on our streets, to learn what our place names mean. You encounter a person on Broadway who seems to have a moment's leisure and ask him the meaning of the name "Boston." One person in a thousand, perhaps, would be able to tell you that our Boston is named after the town of Boston in Lincolnshire, England. To find the derivation of the English Boston you would probably have to make reference to some such source book as "The Place-Names of England and Wales"[1] which would inform you that the name of the English town was originally St. Botolph's town. Old place names are extraordinarily likely to persist even through migrations and conquests, when the spoken language shifts and one tongue is replaced by another. Thus place names remain as puzzles and conundrums for new generations. When the Romans conquered Britain and gave their own names to places, far and wide, they found in southern Britain a big town which they honored by calling "Augusta." Their historian, Ammianus Marcellinus, speaks of setting out from Augusta which the "ancient" people called "London." He probably supposed that the name of the place would remain "Augusta" from his day until the crack of doom; but within a few years the old name London was in universal use again. Concerning the meaning, however, of this old British name there is no certainty today.

What is worse than forgotten origins are deceptive explanations. For example, Bosporus means an "ox-ford"; but whether or not this is the sig-

[1] J. B. Johnston: The Place-Names of England and Wales, London, 1915.

nificance of the English town named Oxford is questionable. This "obvious" meaning is generally disputed, many authorities believing that "ox" is a mistaken Anglo-Saxon identification with one variant of the old Celtic for "water."[2] The case of Cambridge, England, is somewhat similar. The town is on the river Cam, but Cambridge does not mean "Cam-bridge," or bridge over the Cam. This form appears only in the twelfth century. The older name of the river was "Granta." "Cam" is Celtic, "crooked,"[3] i. e. the name originally meant "crooked ford."

The origin of even comparatively modern names is also apt to be lost. Some interesting illustrations from South African place names have been discussed in the *South African Journal of Science*.[4] Bloemfontein may be instanced. This name is variously derived from "flowers and springs" and from Jan Blom, a notorious outlaw of some hundred years ago.

In arriving at the derivation of such place names as those discussed above, dependence is largely placed on documentary evidence. But there is no such line of investigation before the student of Indian place names. All that the observer can do is to ask an Indian what a certain name is believed to mean. A large proportion of these names can be correctly explained, but there is always the difficulty of telling absolutely and finally which out of a number of explanations is correct. As has been said, there is an element of uncertainty here which no scientifically minded person would deny.

The psychological factor back of the difficulty is this: that an informant, especially if he be untrained in the methods of scholarship, will give as the meaning of a name, anything which *sounds* correct. There is a place in England (in Staffordshire) called Talk-on-the-Hill; and the country people explain to strangers that Charles the First held a council of war there. The name is really from the Celtic *twlch*, meaning a "knoll." When the Celtic tongue passed away from the neighborhood, and Saxon came to be spoken, the old name remained but meant nothing to the newcomers; eventually *twlch* was made over into "talk" and the story about Charles added to account for the name. In the state of Washington is a small town called Colby. A local historian quotes seriously a correspondent who says the name was derived from *Coal Bay*, "because some one found a lump of coal by the creek there." Such naive explanations never fail to be entertaining, and no doubt similar "folk etymologies" exist in my own notes concerning Indian names, though the greatest care has been taken to get the etymologies as accurately as possible, and most of them seem to be genuine.[5] With this preliminary caution I now proceed to discuss some of these results.

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[2] Johnston, *op. cit.*, p. 391.

[3] Isaac Taylor: Names and their Histories, New York, 1896, pp. 81–82.

[4] Charles Pettman: An Inquiry into the Derivation of Certain South African Place Names, *South African Journ. of Sci.*, Vol. 12, 1915–16, pp. 159–170 and Vol. 16, 1919–20, pp. 432–442.

[5] On the difficulties of determining the origin of Indian place names compare A. L. Kroeber: California Place Names of Indian Origin, *Univ. of California Publs. in Amer. Archol. and Ethnol.*, Vol. 12, 1916, pp. 31–69.

Characteristics of Indian Place Names

Indians are extraordinarily industrious in applying and inventing names for places. On Puget Sound alone, there seem to have been in the neighborhood of ten thousand proper names. I have secured about half of this number, the remainder having passed out of memory. I am continually warned by Indians that they give me for my maps only a small part of the total number which *once* was used. The rest they have either forgotten or never heard. "The old people could have told you all" is the remark most commonly heard. The vast majority of these names were explained to me after a fashion, but in some cases the Indians themselves had no idea what the name meant, explaining oftentimes that it might be in some foreign or forgotten language. This difficulty, of course, is one commonly experienced in endeavoring to get the meaning of place names among primitive folk—or indeed, one may say, among uneducated people in general. Rodway says the same thing about the Indians of British Guiana. "They use the same words as their fathers but do not trouble to find out their meanings. In some cases the original inhabitants have died out; even tribes are entirely lost, with not even a parrot to give us an idea of their language."[6]

The Vast Number of Local Names

Thus, one phenomenon of wide occurrence among primitive tribes is the vast number of local names in use. In some places in my area the names are so numerous that I could not enter them on a Geological Survey topographic sheet. Even when I represented each name by a number (compare the map herewith) the figures became so crowded together that the whole became illegible. These names often refer to very minute places in the topography. Indeed, it may be stated as a rule that there is a large series of names for small places, with astonishingly few names for the large features of the region. A special name will often be given to a rock no larger than a kitchen table while, on the other hand, what we consider the large and important features of a region's geography often have no names at all. Mountain ranges are nameless; there are no names for bays; in the case of one tribe, the Yurok of northern California, the rivers have no proper names of their own; and islands are nameless, almost without exception.[7] Of 718 names which I collected in the immediate neighborhood of Seattle, independently of other inquirers, less than two dozen referred to the large features of the coast line and relief. In the case of more than 2,000 names collected in northern California, the proportion was even less. This is best illustrated by a few concrete examples.

The Yurok once gave me 12 place names on the slopes of a mountain.

[6] James Rodway: The River-Names of British Guiana, *Bull. Amer. Geogr. Soc.*, Vol. 36, 1904, pp. 396–402; reference on p. 400.

[7] See the author's paper "Yurok Geography," *Univ. of California Publs. in Amer. Archeol. and Ethnol.*, Vol. 16, 1920.

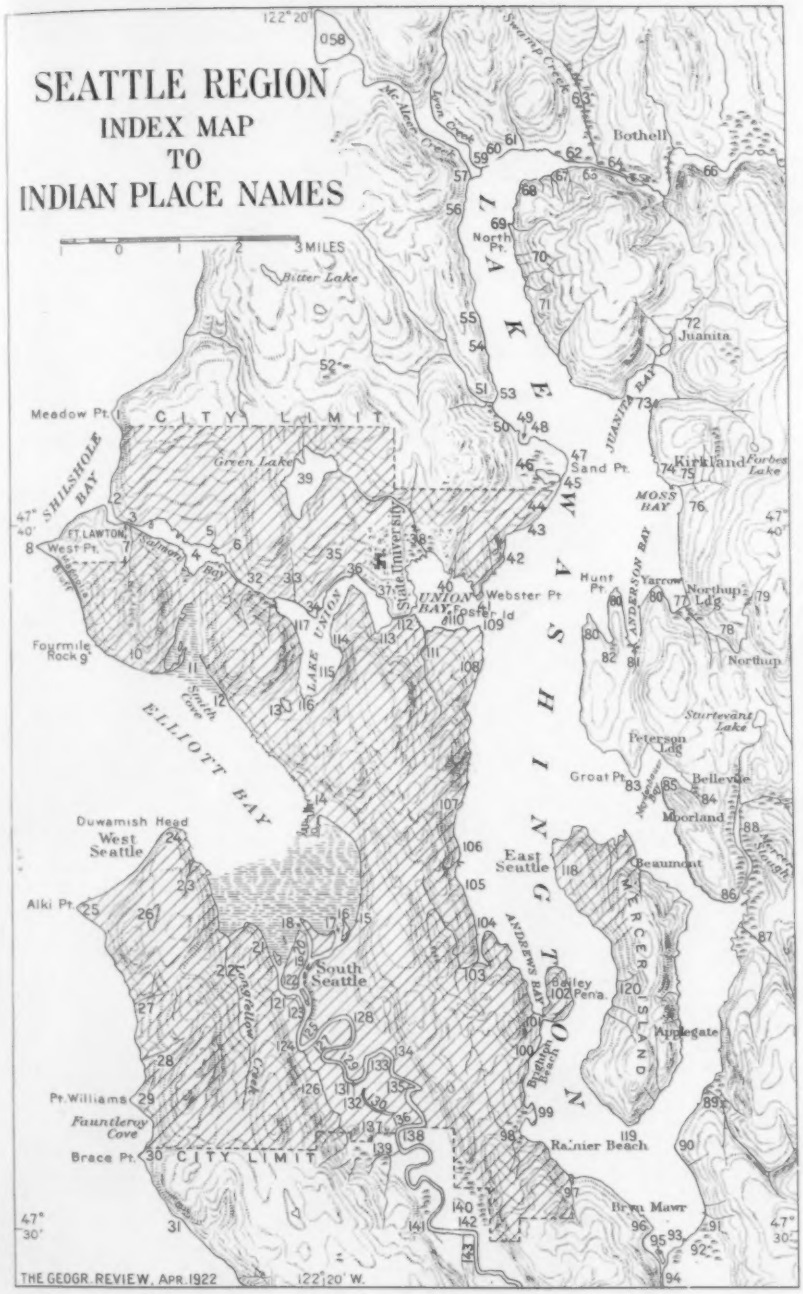

FIG. 1—Key map to Indian place names in the neighborhood of Seattle. Numbers have reference to the names discussed in the Appendix. The shaded area represents the approximate limits of the city of Seattle. The map (scale 1 : 170,000) is based on the U. S. Geological Survey's topographic sheets, Snohomish and Tacoma quadrangles.

One place was an echoing cliff where they shouted out questions about the future, i. e. a place of religious interest; another place was a camas meadow —here the interest is purely dietary, camas being an edible root; another was a place where several trails crossed; and another where passers-by carried out certain observances, i. e. a place of ceremonial interest; but meanwhile they had no name for the mountain *as a whole*. I traveled once on foot for three days toward a great promontory, which, I understood, was called Cu'mig ("Patrick's Point"). When I got there I found that Cu'mig was merely a shelving rock on the side of a promontory.

The Indians of Puget Sound have no names for the Sound, as a body of water, except xwaltc, "salt water," which term they also apply to the Pacific Ocean. I doubt if the Sound ever obtruded itself as a unit into their con-

FIG. 2—The rocks off the extreme tip of Cape Flattery, Washington. These rocks are nothing more than shelving ledges, pounded by a boisterous sea, but they all have their names. The one in the background is called Aawa'tu, or "bald eagle." These birds used to perch on this rock, watching for herring. (Photograph copyrighted by Asahel Curtis.)

sciousness. One of the most conspicuous features of the Sound is a large expanse of land known as Bainbridge Island, lying opposite Seattle. The Indians of Bainbridge Island and of the adjacent shores had no name that I can discover for Bainbridge Island itself. They had, however, upward of three hundred names for different places *on* the island. I have recorded nearly a hundred of them myself. If an Indian in a canoe were "headed," as he would say, for Bainbridge Island and were asked where he was going, he would in reply name the *spot* where he proposed to land. Another striking feature of the Sound is an extraordinary number of narrow inlets. In one place near Olympia an observer in a boat can look into seven inlets at once, raying out like the spokes of a wheel. These inlets have no Indian names. The Indians of Dye's Inlet have, as far as I can discover, no name for the inlet (this is near Bremerton; often called Port Washington). They have

FIG. 3

FIG. 4

FIG. 3—A view of Cape Flattery and the village at Neah Bay. There is a marked contrast, as regards the occurrence of names, between the hills which cause this cape to loom so large and the sea-rocks lying around its base. Only two of the mountains have names: "Trees scattered" and "Cranberries" (CELce'yus and Papke'stao's, in the local dialect). (Photograph copyrighted by Asahel Curtis.)

FIG. 4—The cliffs at Cape Flattery, with Flattery Light in the distance, at the entrance to the Strait of Juan de Fuca. The great crag in the picture is named Fuca's Pillar, after the famous pilot: its Indian name is Tsatsada'x, "standing rock." (Photograph copyrighted by Asahel Curtis.)

a desperately rough series of vocables, Sxaqt, which serves in a general way as a designation of direction thitherward but is really the name of an important Indian village site on the inlet. This site lies on a sand spit east of the town of Silverdale. I have been at Sxaqt and have walked over the site, and it is not more than one eighth of an acre in extent. The Indians had no occasion, it seems, to refer to the harbor as a whole.

I may here stop to remark on the broad significance of this characteristic. Compared with analogous instances among other primitive peoples it appears as an interesting reflex of primitive modes of thought and expression.[8] One may perhaps regard it as a cultural index to some degree. Churchill speaks of "the abundance of minute place names and the almost total absence of designation for the larger geography of islands and archipelagoes" in the South Pacific.[9] Extreme examples of this sort of thing are found among the Melanesians. Polynesians and Micronesians have reached the stage of naming their own individual islands while the Samoans have gone as far as acquiring a "national and archipelagic designation."

Meanings of Indian Place Names

Another difference between our nomenclature and that of the Indian is seen in the nature of the names which the Indian applies to his topography. A good deal of time and effort has been expended in inventing outright rather mawkish terms, which are styled place names and ascribed to the Indian. Thus, some one has put down Mt. Rainier as having an Indian name meaning "nourishing bosom," and this "on account of the numerous streams which spring from the glaciers." "Home of the Winds" is applied to a second peak. As a matter of fact, neither of these terms bears inquiry for a moment; I never found an Indian who recognized them, nor have I ever recorded any Indian place names at all analogous to them. This, however, is not to say that the Indian lacks poetry in his make-up. He has the poetic instinct and along with it an appreciation of beauty, ranging from that of basket designs to that of majestic scenery. But his "poetry" does not take the form of far-fetched metaphor nor clothe itself in weak and transparent allegory. Nor does the Indian sentimentalize over the scenery.

The actual place names used by the Indian, as far as those which I have obtained may be considered as evidence, are of a totally different character from those I have just mentioned. The vast bulk of his names are descriptive and commonplace. For example, a thing he is intensely interested in is food, having a distinct resemblance in this respect to ourselves. Our food, however, comes to us so easily and regularly, as the result

[8] Compare J. R. L. Kingon: A Survey of Aboriginal Place-Names, *South African Journ. of Sci.*, Vol. 15, 1918–19, pp. 712–779. Treating of this feature of native place names in South Africa he says: "Everyone who has had any insight into the Native mind and method will be familiar with the immense detail which burdens their narratives of even simple events—and, naturally, this immense detail is to be reckoned with in any study of the place-names, for the smallest of places seems to have its name" (p. 713).

[9] William Churchill: Geographical Nomenclature of American Samoa, *Bull. Amer. Geogr. Soc.*, Vol. 45, 1913, pp. 187–193; reference on p. 187.

of our economic and industrial system, that we have to take no direct thought concerning it. Not so with the Indian. He lived on a plane where economic security was undreamed of, and, after breakfast was over and the "things cleared up," luncheon became usually a matter of the greatest moment and the liveliest concern. It is not astonishing, therefore, to find

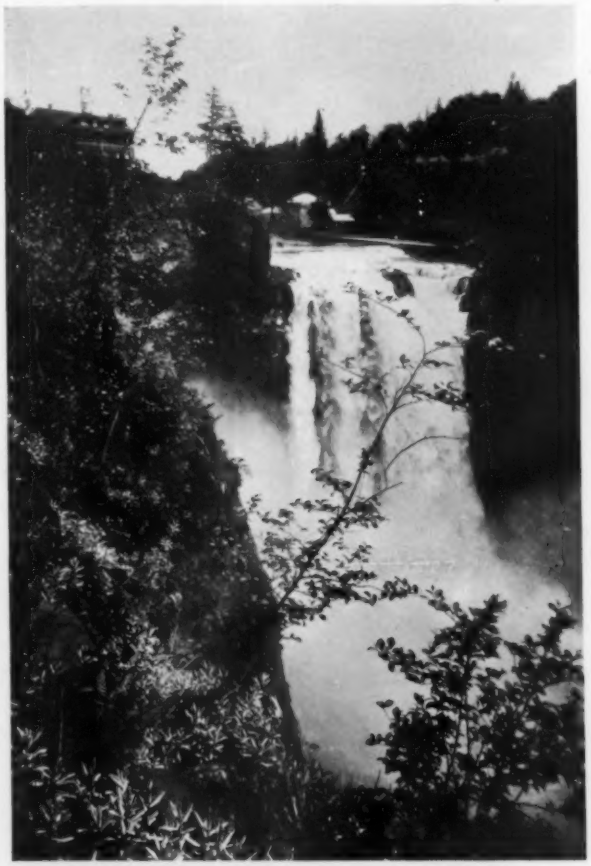

FIG. 5—Snoqualmie Falls, Washington. The river plunges with wild abandon into a rocky caldron, amid a fury of sound and a storm of spray. The bottom of the falls the Indian calls simply Sqwud, or "below part." The rim of rock over which the river leaps he calls SkaLdaL, the word for a person's upper lip.

that a large number of Indian geographical names bear directly on his food supply. Names like "Dog-salmon place" for an inlet or "Wild-potato place" for a meadow are part of the prevailing mode in place names. A very large item in his geographical psychology is the grounds where materials are obtained for technologic processes. "Cedar place" and "Where-they-slide-

planks-down-from-the-hillside" are examples. Along with these commonplace terms, place names famous for their mythological significance are very frequent, associated closely with spots sacred to supernatural beings—spots particularly where various taboos are to be observed. I have in mind, for example, a certain big rock on the Klamath River, in front of which no woman or corpse is allowed to pass in a canoe. The rock (or the being who dwells in it) will not permit such familiarity. Women walk, and corpses are carried, on the *landward* side of this rock and re-embark in the canoe out of eyeshot. There are a number of such boulders along the Klamath, and each one has its own proper name. At Bremerton, Wash., near the great Puget Sound Naval Station, is a small rock called Xa'xE', "forbidden." No canoe may run aground on this rock. If that should occur, the occupants would soon die—unless, perchance, they know the proper song to sing. This song, in my own orthography,[10] is as follows:

LatL'a'xtcEda'l tis wat'i^{u}tid
gwEla hôi yahaL

"I will continue to grow in this world
Then it will be good for me!"

In a list of Indian place names there are likely to be hundreds of this character. Often the rocks and other topographic features which figure in the myths are to our eyes most unimpressive, while places impressive to us often remain nameless. For example, the state of Washington boasts one of the finest cascades imaginable, Snoqualmie Falls. A considerable river leaps out over a bluff and descends into a chasm with thundering reverberation and a cloud of mist. One would certainly suppose that the neighborhood would be a place of more or less mystery and awe. I own I expected to encounter something very impressive in the way of names when I asked what the falls were called. The place where the water descends, where the thunder of its fall is loudest, is called Sqwud, which means "underneath" or "below." The upper part, where the waters take their leap, is called SkaLdaL, or "lip." Here, in the most romantic surroundings, Indian nomenclature is most laconic and matter-of-fact. On the other hand, the Indian is often affected by very commonplace objects. I was told that a certain region along the shore south of Seattle was "mysterious." The Indians never went there; they never even looked in that direction. This was because there was a certain wonderful rock there, it seemed, that shed its potent influence over the whole landscape far and wide. If any one looked at it, he became twisted! His head, from the power of the rock, would twist right around on his neck, and so on. The very Indians who told me about the boulder had themselves never seen it because they were unwilling to go near it. It turned out that this boulder was not more than four feet high—a most ordinary-looking red stone; and I could not help wondering

[10] For the values see Appendix, p. 187.

in what quaint and curious way and by what strange psychological twist its reputation for the marvelous had become established and spread abroad.

The examination of Indian local names opens up most interesting material in the way of folklore, and we have in myths and religious sentiments an important source of Indian geographical names. A certain number of Indian places get their names from the accidental resemblance of rocks or other natural objects to living creatures. The resemblance in such cases is seldom striking, the barest suggestion of a resemblance often seeming remarkable to the Indian's mind. But such origins are relatively rare. I have recorded "resembling a bosom," "standing like a person," and "elk, similar-to" among others. However, the place names that contain the stem "elk" or refer to the elk usually indicate the actual presence there of the animal in question and not to a myth about it, or anything in its contour.

The repeated use of a given geographic name is characteristic of the Indians, as of ourselves. In our own maps of the various states or counties, the number of Pine Creeks and Mill Creeks and Rock Creeks and Deer Creeks and bald and meaningless town names ending in -ville is almost appalling. Similarly there are certain geographic names which are very popular among the Indians. In the region of Puget Sound the most popular name contains the stem *ba'kwob*, which means "prairie," or open place among the trees. It occurs in a number of forms—Ba'kwob, Baba'kwob, Ba'q baqwob, BEbqwa'bEbs, SbEqwa'bEqs. Another stem which recurs very often is *bul*, which means "to boil." Thus we find Bul'äts, a place in a bend of Port Washington harbor where springs issue forth on the beach; Ba'lE'q, a bog near the Dwamish River with a spring in the center of it; BE'lspidop, a place in the river where the water boils up; BElqks, "boiling promontory," a place near Bremerton where the tide rips boil around the tip of a point; and a place called Bu'lbul'Ets in Quartermaster Harbor where there are several springs on the beach. All of these contain the same stem.

The actual statistics concerning the various sorts of names used by the people of one specific area on Puget Sound may serve as an example of primitive nomenclature.

Place Names Consisting of:	*Number of Such Names*
Descriptive terms	202
References to mythical episodes	67
References to animals	35
References to the food supply	34
References to human activities	33
References to plants	24
Unclassified terms	49
Untranslated terms	137

There is obviously some overlapping among the above categories. For example, the term "Food supply" includes certain items which might also go under the term "Animals." The list shows clearly, however, a pre-

dominance of descriptive terms and mythological allusions. The descriptive terms consist of a great variety of expressions. Some of them have reference to parts of the body, based on real or fancied resemblance in configuration; others consist of expressions such as "curled about," or "thrust out," or "sand spit projecting out under a headland," or "abounding in miry places."

Indian Place Names About Seattle

In order to illustrate the large number of Indian place names found in a region and to give some impression of the Indian's psychology and the way in which terms are applied, I have selected for reproduction a small portion of a map showing the Indian names for places on the eastern side of Puget Sound. The area is just in and about the city of Seattle. The actual topography is very interesting, and the spot is doubly interesting because of the great city which has grown up there. The Indian names obtained are given as an Appendix to this article.[11]

From our own standpoint, the Indian's conception of the size of the world is startlingly inadequate. In southern California I obtained from a Diegueño Indian a sketch of the universe as he knew it, including the mountains which lie on the uttermost rim of things. His world was inclosed between four peaks, Mt. San Bernardino, Mt. San Jacinto, Coronado Island, lying just off of San Diego harbor, and a mysterious mountain on the lower Colorado River. Thus his world was a disk only about two hundred miles across. The Yuroks in northern California were not quite so cramped. They knew of a lot of mythical regions beyond the sky, while the expanse they were actually acquainted with in a geographic sense was limited practically to the five counties of Del Norte, Humboldt, Siskiyou, Trinity, and Shasta.[12] The Indians on Puget Sound had a still larger outlook, being a seafaring people and somewhat widely traveled; but even they place the boundaries of the horizon within twenty days' journey. The old Indians I have talked with knew in a way of the city of Washington, because the President and the Commissioner of Indian Affairs live there; and of Chicago and St. Louis, because they send their furs there for market; but the older people, at least, have no idea of the distance from the Pacific Coast to these places. All of these people picture the earth as flat and the sky as a solid vault overhead.

Geographical concepts certainly have undergone a very remarkable development. The concept which seems the simplest and most obvious, such as giving the whole of a district, or the whole of a mountain-range, one name, has actually been, like the concept of the real size of our world and its sphericity, the result of long evolution.

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[11] Another author, Costello (in the *Siwash*, Seattle, 1895), has given a brief list of native names in this neighborhood.

[12] See the diagram illustrating the Yurok idea of the world reproduced in the *Geogr. Rev.*, Vol. 10, 1920, p. 414.

Appendix

The names in the Seattle area, as obtained by myself, are written out in the phonetic orthography used by ethnologists. A special way of writing Indian words is rendered necessary by the fact that the Salish dialect spoken at Seattle has many sounds which do not occur in English. Briefly, in the names here printed the ordinary vowels have their European value. The symbol "E" has the sound of "u" in "but;" "L" is a surd "l;" "q" is a velar, or "back," "k;" "c" has the value of English "sh;" "tc" has the value of "ch" in "church;" "x" the value of "ch" in Scottish "loch;" the apostrophe (') is a glottal stop. In connection with pronunciation consonants marked ! are exploded, and ′ is a stress accent, as in English. Open vowels are marked with a breve (˘). Letters printed above the line indicate sounds which are imperfectly articulated.

The numbers printed in front of these names indicate position on the map, where they are entered in the proper order beginning at the northwestern corner.

Names of Places on the Shore of Puget Sound Near Seattle

1. Meadow Point, a sandy promontory north of the Ballard District, Seattle: Qe′L^{E}bEd. The word suggests Qe′lbid, "canoe."

2. A very minute promontory, barely visible on the map, at the northern side of the entrance to Salmon Bay in the Ballard District, Seattle: Tce′dkedad, "lying curled on a pillow." The name refers to the shape of the spit, which is curled about on itself, owing to the wash of the tides at that point. There were formerly many clams here.

3. The narrow opening which leads into Salmon Bay: Cilco′l-utsid, "mouth of Ci′lcol" (see below).

4. Salmon Bay: Ci′lcol, "shoving a thread through a bead;" "threading or inserting something." The Indians used to paddle in from the Sound and traverse the length of this inlet on their way to Lake Washington. The name refers to the way in which this narrow estuary invades the shore line. Costello gives for Salmon Bay "Shul-shale, the name of a tribe." He is very much misled in this matter. The tribe were the Cilcol-a′bc or "Shilsholamish," "dwellers on Shilshole." It is noteworthy that the word Shilshole, which is a transcription in ordinary spelling of the Indian name, still appears on the map, but it has drifted down with the tide, so to speak, and has now come to rest in the waters outside of the "heads," which are the Shilshole Bay of recent published maps.

5. A very small creek entering the northern side of Salmon Bay: Bitida′kt, "a kind of supernatural power." This "power" enabled one to journey to the underworld and recover souls from the land of the dead. The performances and paraphernalia of the ceremony have often been described; for example, by Dorsey, in the *Univ. of Pennsylvania Museum Bulletin*, and by Haeberlin, in the *Amer. Anthropologist*.

6. A still smaller creek than the above, entering the same tiny inlet: Qw!ula′stab, "a small bush with white flowers and black berries." This is not the dogwood, as might seem likely, but some other plant.

7. A creek which drains down a straight gully into the southern side of Salmon Bay from the neighborhood of Fort Lawton: Hwiwa′ĭq, said to mean "large; having lots of water."

8. West Point, a promontory ending in an elongated sand spit: Pka′dzEltcu, "thrust far out." This cape lies just north of Seattle harbor, or Elliott Bay. The stem is *paLkt*, "to thrust ahead," or "to push one's way through brush," for example. It is also used of leaves "pushing out" in the spring. The terms refers to the way in which the point seems to thrust itself forward into the Sound. Costello gives Per-co-dus-chule, not translated.

9. Four-mile Rock: LE'plEpL. The rock in question is a great boulder standing in the water at the foot of Magnolia Bluff. Its name was also recorded in the form La'pub. Another name, Tc!ĕ'tla, which is sometimes used, means simply "rock;" "boulder." A myth recounts that an ancient hero named Sta'kub could take a gigantic dragnet made of cedar and hazel branches and throw it over this rock while standing himself on the distant beach.

10. A small creek draining down a gully from Fort Lawton: TLo'xwatL-qo, "land-otter water." This creek flowed only in wet weather. The gully is now occupied by a paved road.

11. Mouth of the creek draining into Smith Cove: Sila'qwotsid, said to mean "talking."

12. A creek formerly entering the Sound south of Smith Cove: T!E'kEp, "an aerial net for snaring ducks." It is said that ducks which were "started up" on Lake Union would always fly over the low place between Queen Anne Hill and the business district of Seattle. Duck snares were accordingly set at this point. It is also said to have been used by the Indians as a camping place.

13. An open space, or series of spaces, in the forest which formerly grew north of what is now the business district of Seattle: Baba'kwob, "prairies" (*ba'kwob*, "prairie"). The earliest white settlement at this point was called Belltown. It lay just north of the present water front with its wharves.

14. A village site in Seattle: Djidjilal'ĭtc, a diminutive, meaning "a little place where one crosses over." At this point there formerly extended a little promontory with a lagoon behind it. On the promontory were a few trees, and behind this clump of trees a trail led from the beach over to the lagoon; hence the name. Indian villages existed on each side of this point and flounders were plentiful in the lagoon. This is exactly where the King Street Station now stands. The term for this spot is now applied by Indians to the whole city.

15. A little "spit," or beach, at the edge of the easternmost of the mouths of the Dwamish River: ^{Tux}pa'ctEb.

16. A small promontory on an island: Tĕta'lks. The place is said to have been used as a lookout point by the Indians, who built a stockade here.

17. A slough passing to the south of the above: Slu'wĭL. The term means literally "a perforation for a canoe." The word *slu* is applied, for example, to the holes bored to test the thickness of a canoe hull. In the present case the word refers to a grassy marsh intersected with channels, into and through which canoes can be pushed. The term was also defined to me as "a short cut;" "a canoe pass."

18. The largest of the branches into which Dwamish River divides at its mouth: XwEq!, "slough."

19. A place on the western shore of the above slough: Q!ulq!ula'di, "shaggy," "tangled." The stem *qul* means "bad," "brushy." A lot of fir "snags" or "stubs" (that is tree trunks with the roots attached) drifted in here and lodged, masking the shore so that no one could land.

20. Harbor Island, a flat surrounded by watercourses, and rather marshy: Ts!E'kas, "muddy." An old informant, George Si'towaL, lived in a float house here with his aged wife until in the year 1920 they starved to death.

21. An old village site on the western bank of the Dwamish, at the foot of the bluff: Tul'a'lt^{u}, "herring's house."

22. Longfellow Creek, draining into Young's Cove, in West Seattle: Tua'wi, "trout."

23. A trickle of water draining down a little gully near Luna Park in West Seattle: ^{Cuxu}tsE'xud, "something to split with."

24. Dwamish Head: SqwEdqs, "promontory at the foot of something" (*sqwEd*, "the under part of anything;" *qs*, "promontory"). The name is descriptive of the sand spit which juts forward from the foot of an abrupt overbeetling headland, once heavily timbered. Costello gives the name Squ-ducks for this place, translating it "promontory."

25. Alki Point: SbEkwa'b ^{E}qs, "prairies" (*ba'kwob*, "prairie"), so named because the flat, sandy promontory, which juts out half a mile from the shore line, had among the trees many open places.

26. A depression a mile or more inland from Dwamish Head: ^{Tux}qo'tEb. This lies on top of the plateau and was once a cranberry swamp.

27. A small creek south of Alki Point: T!E'sbEd, "a winter house" (*t!as*, "cold"). The reason for giving this name to the place I do not know. There was a brickyard here some years ago.

28. Another small creek, south of the preceding: GwEl, "to capsize."

29. Point Williams: Tcîxha'idus, "crowded," "tight."

30. Brace Point: Psaiya'hus, "horned snake." This promontory was considered to be the abode of one of these monsters. They were regarded with supernatural dread. They take the form of an enormous snake, having, according to some accounts, the antlers and forelegs of a deer. At the base of this promontory is a big reddish boulder weighing half a ton or more. It was formerly believed that anyone looking at this boulder would become twisted into a knot. The boulder itself was believed to change its form. Certain people had this boulder for a supernatural helper.

31. A bend, or cove, south of Brace Point: ^{Tu}kwa'sus, "scorching the face." There is a gravel pit here now.

Names of Places on Lake Union and Lake Washington

The author already mentioned, Costello, gives two curious words for the names of these two lakes. He says that the name for Lake Washington is At-kow-chug, meaning "large body of fresh water," while for Lake Union he gives the name Kah-chug, which he translates "lake." As a matter of fact these two expressions are forms of the same word, though from our author's way of transcribing them one would hardly suspect it. The word for Lake Washington is Xa'tcu, which is simply a word for "lake." This is the one spelled "At-kow-chug" by Costello. To form the name for Lake Union, the Indians insert a "glottal stop" in this word, which makes a diminutive of it and gives the form Xa''tcu. This closely resembles the other word but means "little lake." Used as a name for Lake Union, it is the term written by Costello "Kah-chug." His remarks are therefore an indirect approximation to the truth. Lake Sammamish, which is east of Lake Washington, the Indians call Xa'tcxatcu, which also means a small lake but one not quite so small as a Xa''tcu.

32. A place on Lake Union, where an outlet drains into Salmon Bay: Gwa'xwop, "outlet." The stream flowing in this channel now supplies the locks of the Government Canal.

33. A small creek, just east of the railroad bridge in the Ballard District, Seattle: Ctciwa't-qo, "place where one whips the water." The people used to hit the water with sticks to drive fish into the narrow brook, where they were easily captured.

34. A promontory jutting into Lake Union from its northern shore: Stĕ'tciL, "a prop." It looks, say my informants, as though it were "leaning against" the opposite shore. This promontory is now occupied by a gas plant.

35. A "prairie," or open space, near Lake Union: Ba'qwob. This was at the northern abutment of the Latona bridge, in the city of Seattle.

36. A small creek entering Lake Union just east of the Latona bridge: Waq!e'q!ab (waq!e'q!, "frog").

37. A tiny promontory jutting into Lake Union, where the boathouse of the University Boat Club now stands: Sqwitsqs, "little promontory."

38. The marsh lying between Laurel Point and the buildings of the University of Washington: SLuwi'L, "perforation for a canoe." The term refers to the fact that the marsh was intersected with channels into which a canoe could be thrust. The creek which enters the bay through this swamp flows out of Green Lake through a conduit into Ravenna Park. A large aboriginal fish trap made of piles formerly stood in this bay. Its ruins are said to have been exposed some years ago when the level of the lake was lowered by the digging of a canal.

39. Green Lake: ^{Du}tLĕ'c. This lake furnished quantities of suckers and perch, which were taken in basket traps. Salmon also entered the lake by the creek mentioned just above.

40. A little cove on the western side of Laurel Point: A'did, an exclamation translated "Dear me!" The spot was formerly the property of a certain Joe Somers and previously to that had been set aside as a camping place for Indians.

41. Laurel Point: Cebu'lt^{u}, "dry." This promontory is now called "Webster Point" on the maps and is styled "Whiskey Point" by Indian informants.

42. The shore of Lake Washington, north of Laurel Point: ^{Tu}tsa'xwub, "beating." A fine cliff here, overshadowed with heavy timber, overhangs the beach.

43. A spot on the beach north of the preceding: T!lels, "minnows," or "shiners." These are otherwise called tomcod, I believe.

44. A flat open area without timber, south of Sand Point: BEbqwa'bEks, "prairies" (*cf. ba'kwob*, "prairie").

45. A little channel which drains a pond south of Sand Point: Tc!aa'Lqo, "channel," "watercourse." There is a myth which refers to this channel, but I could not obtain the details.

46. The pond at Sand Point: Wisa'lpEbc.

47. Sand Point, an extensive promontory, very level: Sq^{w}sEb.

48. The northern shore of Sand Point: T!uda'xEde, a plant with small, inedible white berries.

49. Cove at the inner end of the promontory: Sla'gwElagwEts, literally "cedar bark, where it grows."

50. The shore north of the preceding: XwExwi'yaqwais, said to mean "pulling on a line which is made fast to something."

51. A creek north of Sand Point: ^{Tu}xu'bid.

52. A cranberry marsh lying some three miles from the lake shore: SLo'q!qed, "bald head." This marsh is drained by one branch of the creek just mentioned.

53. A little promontory: Tsixtsix-a'lt^{u}, "eagles' house." There is the nest of an eagle (*tsistsis*) in a tree on this point.

54. A place on the lake shore, at the edge of a bluff: Xwiyaqwa'dĭ-a'lt^{u}, "thunderbird's house." The mythical fowls which are supposed to cause thunderstorms by clapping their wings and winking their eyes were believed to nest here in the trees.

55. A very "dangerous" place at the edge of the lake: StL!Epqs, "deep promontory." People swimming here were formerly "taken away" by something supernatural.

56. An enormous boulder on the lake shore: ^{Hs}tcĕ'tla, "rock."

57. The mouth of McAleer Creek: S!a'tsutsid, "mouth of s!a'tsu." (See No. 58.)

58. McAleer Lake: S!a'tsu, "face."

59. A small creek: Sts!kE'l, "a certain small bird."

60. A spot where a sawmill stands, at the northern end of Lake Washington: Sta'tabEb, "lots of people talking."

61. A small creek: Tcĕtca'L.

62. A level flat at the mouth of Swamp Creek: Ts!Ebta'lt^{u}, "elderberry's house" (*ts'abt*, "elderberry").

63. Swamp Creek: TuLq!a'b, variously translated. The word Lq!ab means "the bark of a dog." Another informant said that the present term means "the other side of something," like the opposite surface of a log.

64. An old village site on the northern shore of the lake, at its head, near where the Sammamish River enters: TL!ahwa'dĭs, "something growing or sprouting." According to informants dwelling on the Sound the people here were "poor."

65. Where Sammamish River enters Lake Washington: Cxa'tcugwEs, "where the lake becomes elongated." The expression refers to the way in which the lake at its northern end gradually narrows into a long estuary.

66. Squawk Slough, otherwise known as Sammamish River: sts!ap, "crooked," "meandering." This stream was originally crooked almost past belief. It has now been dredged out and straightened, so that mill logs can be floated through it from the lake above. The people living here were called the sts!apa'bc, "meander dwellers," anglicized as "Sammamish." This name for the people has now been applied to the lake and the river.

67. Peterson's Point: Qwai'tĕd, said to mean "across." This is a headland lying south of the mouth of Sammamish River.

68. A small promontory: Xwi'alad^{xu}, "niggardly;" "scanty." It was difficult to catch fish at this place; whence the name.

69. North Point: U'a's, "gravel rattling down." Gravel continuously rolls down from this promontory.

70. A spot on the eastern shore of Lake Washington, south of the preceding: Li'lskut.

71. An open space near the present town of Juanita: Tcĕ'tcubEd.

72. The creek at Juanita: TE'btubĭ^{u}, "loamy place" (tE'b^{u}, "earth," "loam").

73. Nelson Point: Leqa'bt, translated "paint." The term means literally "something gathered or scooped up with the fingers." Material called "rust" by my informants (evidently ochre) was scraped from a cliff at this point and baked in a bonfire. The reddest portions were then picked out and used for face paint.

74. The beach north of the town of Kirkland: Wĭcqab-al't^{u}.

75. A water channel on the hillside north of the town of Kirkland: Tse'xub, "dripping water."

76. The site of the town of Kirkland: Sta'LaL.

77. The mouth of Northup Creek, south of Kirkland: Tc!u'tsid, "mouth of Tc!u." (See below.)

78. Northup Creek: Tc!u.

79. A swamp at the head of Northup Creek: Txwa'bats, "pulling something toward one."

80. Three promontories with narrow inlets between: "SLi^{u}Li'uqs, "three promontories" (*Liux*, "three"). The promontories are Hunt Point, Fairweather Point, and a third which has no name in English.

81. A small creek at the head of Anderson's Bay: Tca'bqwEsEbEts.

82. A small marsh at the head of the inlet west of the above: DE'q!tus.

83. Groat Point, near Peterson's Landing: CtcE'gwus, "place where a trail descends into the water."

84. A little creek at head of Meydenbauer Inlet: TLhai'si, named for a certain species of fish. This fish, called *tLhais*, has a stripe on the side and is very bony. They "ran" in great numbers at this point.

85. A promontory south of Meydenbauer Inlet: Lcwild.

86. A promontory west of Mercer Slough: TL!utsa''lus, "tying a mesh."

87. Coal Creek: SqE'bEqsĭd.

88. Mercer Slough: Sa'tsakaL, "water at head of a bay," an old village site.

89. May Creek: Cbal't^{u}, "place where things are dried." Great quantities of redfish were taken at this point.

90. A small promontory: Kwa'kwau.

91. A place opposite the south end of Mercer Island, at the foot of Lake Washington: P!E'swi, "pressed back;" "crowded back."

92. Marshes at the south end of Lake Washington, to the east of Black River: Spa'pLxad, "marshes." The word was given to me also in the form Spapa'pLxad, "several little marshes."

93. A little promontory on the lake shore at the middle of the marshy flats just mentioned: ^{Tu}ci'tsabd^{u}, "to thrust or shove," especially to shove one's canoe into the brush.

94. Where Black River flows out of Lake Washington: Ciqe'd, "head," or "source." This is "the place from which Black River starts," whence the name.

95. A place near the head of Black River (probably the small island there): Tcitc!o'yaq^{w}.

96. An old village site at a place now called Bryn Mawr: SExt!i'tcĭb, "place where one wades."

97. A small creek north of Bryn Mawr: Tsi'ptsip, "ducklings." The term means literally "something which emits a squeak or peep."

98. A creek draining into an inlet north of Ranier Beach: ^{Tux}wöo'kwib, "loon." Surrounding this inlet there is a deep swamp or marsh where loons nested.

99. A promontory, separated from the mainland by the marsh just mentioned: TLĭ'Ltcus, "small island." It lies west of the south end of Mercer Island.

100. Brighton Beach: Xaxao'Ltc, "taboo;" "forbidden." Some supernatural monster lived at this point.

101. The isthmus connecting Bailey Peninsula with the mainland: Cka'lapsEb, "the upper part of one's neck." It is employed regularly in the sense of "isthmus."

102. Bailey Peninsula, especially its northern end: SkEba'kst, "nose" (bE'kšid, "nostril").

103. A creek emptying into Wetmore Slough: Sqa'tsid, "choked-up mouth;" *asɑqo'tsid* is is the expression for closing a door, or blocking up an opening. A lot of snags here blocked up the mouth of the creek. The place was at one time a hopyard. Silver salmon formerly frequented this creek.

104. Wetmore Slough (or place on the shore of the slough): Ska'bo, "nipple," or "milk."

105. A place on the lake shore, opposite the northern end of Mercer Island: Saiya'hos, "horned snake." This is an enormous supernatural monster which lived at this point on the shore.

106. A place slightly north of the preceding: Hwoqwe'yE-qwaiEks, "rushes used for a certain kind of matting." This rush, the name for which was given to me in the form sqwe'-qwats, is smaller than the cat-tail.

107. A place near Yesler Park: Bisti'Exq!e'u. This word was untranslated; but it suggested to one of my informants *stik!a'iyu*, "wolf." The water is very deep here.

108. Madison Park, at the end of the Madison Street cable line: XětL, "where one chops." I do not know the reason for the name.

109. The southernmost of the two promontories forming Union Bay: Biskwi'kwiL, "skate." This point of land is very level and is turned up at the tip, resembling the nose of a skate.

110. Foster Island, a small island in Union Bay: Sti'tĭtci, diminutive of stE'tci, "island." This island was formerly used as a graveyard. The Indians of this part of America formerly hoisted their dead into the trees. My informants can remember when the trees here were full of boxes with skeletons in them. The lashings of these boxes gave way from time to time, and the ground was covered with bones which had rattled down from above.

111. A creek entering Union Bay from the south: Sta'LaL (*staL*, "fathom;" "stretch of the arms"). I do not know the reason for this name.

112. A place where there was formerly "portage" from Lake Washington to Lake Union: Sxwa'tsugwĭL. The stem means "to lift up." The suffix, -gwiL, is well known in the Salish dialects and means "with reference to a canoe." The whole name means "where one lifts his canoe." Costello gives this term as "Squaltz-quilth," not translated. At this point the Indians, and after them the early settlers, carried their boats from one lake to the other. The path which they followed was just south of where the present canal is cut. I am informed that a little creek drained out of Lake Washington, up which the boats were pushed as far as they could be made to go.

113. The flats at the southern end of the bight in Lake Union, facing the University campus: Spa'Lxad, "marsh," "wet flats."

114. A place on the shore of Lake Union, opposite the present site of the gas works: Sxwuba'bats, "place where jumping occurred." A number of house boats are now moored along the water front here. One informant explained that the water front here was encumbered with logs over which one had to jump.

115. A place just south of the preceding: StLĕp, "deep." The beach here is very abrupt.

116. A place at the southern end of Lake Union: Ctca'q"cid, "where a trail descends to the water." At this point an old trail from Seattle harbor came down the hill to Lake Union. This is where the pioneer sawmill stood, belonging to David Denny ("Dabe Duddy" according to the Indian pronunciation of his name).

117. A bluff at the foot of Lake Union on the southern shore: TL!pe'lgwĭL, "deep for canoes."

118. East Seattle, a district on the northern end of Mercer Island: TsEktsEk!a'bats, "where gooseberry bushes grow." The particular locality named herein is the site of the old Proctor Ranch. Wild roses were formerly plentiful here.

119. South Point, the southernmost promontory of Mercer Island: La'gwĭtsatEb, "taking off;" "stripping." An old man once went to this place in a canoe to get bark from the dead trees. The influences there caused him to become "crazy," however, and he had to go away. There were supernatural beings there, called *swa'wats"tĭd*, "earth beings," living in the old stumps. Removing the bark from the stumps, therefore, was like removing clothing from a person. The Indians were afraid to go to the spot after that.

120. A place on the western shore of Mercer Island: Q!oq!o'btsi, "water lilies," a plant with a large yellow flower.

Names of Places Along Dwamish River

121. An old village site on the western bank of the river: Yile'q!ud, said to mean a basket cap such as that worn by the Yakima people.

122. A spot at the southern end of Harbor Island: Ska'bk!abEb, "backwater where there is no current."

123. A level flat on the western side of the Dwamish: Xo'lxolp!i, "grassy place."

124. A spot on the western side of the Dwamish, where a bend in the river washes the foot of the bluffs: Tkba'le, "spot where they place an aerial net for trapping ducks."

125. A point of land on the eastern side of the river: TcE'btcEbid, "fir trees on the ground." People went there to get dry bark for fuel.

126. A small creek entering the Dwamish from the west: Ta'litc, "a frame for drying fish."

127. A slough cutting across a point: TatL!qe'd, "head of the short cut." At high tide the Indians made a short cut through a channel here in going up the river in their canoes.

128. A bank or cliff on the eastern side of the Dwamish: Bia'ptEb, "ground dropping down" (*bia'p*, "to fall"). Material is continually falling from the bank here.

129. A place below Georgetown: Ts!kwa'lad, "forked house post." The river forms curves suggesting the shape of this timber (see map).

130. A small channel across a flat on the western side of the river: Lwalb, "abandoned." It is an old river channel, the river having changed its course.

131. A place where there were numerous tree trunks and dead timber: T!a'Lt!aLusid, translated "where there is something overhead across the path." The term in its literal sense signifies the crossbeams in the roof of a house.

132. A place on the western bank of the river: Hutcsa'tci, "hand cut in two." Several legends cluster around this spot, and the Indians call it a "bad place," meaning that supernatural beings lurk here. Once some people were passing this spot in a canoe, going up river. They were conversing about the name. "I wonder why this place has the name 'hand-cut-in-two,'" said one of them. A hand suddenly rose up out of the river, the fingers of which were cut off. The hand stood up by the boat, and the supernatural being down in the river spoke. "*That* is why," was all that he said. The people, of course, were terrified.

At the time when the Transformer came two men were fighting here. He turned one of them into a large cottonwood tree on the western bank, which still shoots sparks occasionally at its ancient enemy—a big white fir across the river. One of my informants once, on a pitch-dark night, saw sparks passing back and forth across the river!

133. A large flat in a bend of the river: ^{Tu}qwe'Ltĭd, "a large open space;" "a plain." A village stood here.

134. A place where a lot of material caved down on a trail: TEtc!gwEs, "a brace or upright supporting a rafter." I fancy that the name came from some tree trunks involved in the landslide.

135. A narrow promontory about which the river makes a sharp turn: Cka'lapsEb, "neck." This was formerly an open place where they got camas (lily bulbs) for food.

136. A place on a wide flat, near the head of the old river channel mentioned above: Hwa'pitcĭd, "where one throws something." I do not know the reason for the name.

137. A place where there are three symmetrical knolls on an extensive flat, on the western side of the river, in South Park: Qiyawa'lapsEb. The name suggests "eel's throat" to one of

my informants (*quya'u*, "eel"). The largest knoll is surmounted now by a Catholic orphanage.

138. A flat in a bend of the river on the eastern side: Xo'bxobti, "canoe paddles." Ash trees here, which supplied wood for paddles, gave the place its name.

139. A small creek entering the Dwamish from the west: GwExhwallt^{u}. This term suggests to my informants *gwEx*^{w}, "string," and *alt*^{u}, "house." I do not know the reason for calling it this name.

140. An isolated knoll north of the bridge where the Puget Sound electric trains cross the Dwamish on the way to Tacoma: Cxi'yaq^{u}, said to mean "beaver." This and two other near-by elevations stand out on the plain separate from the near-by ridge. They are the scene of a famous story, the legend of North Wind and South Wind. In effect it is as follows: North Wind, whose name is Stu'bla, had a village on the lower part of the Dwamish. South Wind had a village farther up the stream. War arose, and while South Wind and his people were destroyed, his wife, Mountain Beaver, escaped *by digging through the ground* and went to her father. There her baby boy grew up. With the help of his old grandmother, young South Wind afterwards put North Wind to flight. The last place where the latter stopped was at the present Yeomalt (west of the Sound). This name is an Americanization of Yeboa'lt^{u}, "fighting house," which was formerly spelled on the early maps Yemoalt (notice the order of the letters, which has undergone a change on modern maps). Here the two winds had their last "tussle." Hence the breakers roll high on that point even today. This is why we do not have constant winter in the Dwamish valley, they say. South Wind drove North Wind away.

141. A place on the hillside south of the Interurban bridge just mentioned: Stu'bla, "North Wind." This is the site of North Wind's ancient village. A few yards below this spot a great reef of rocks stretches across the river, representing his fish dam, destroyed and ruined by young South Wind.

142. A conical elevation crowned with large boulders, just at the bridge: Stkax^{u}, "beaver-lodge." I think it derives its name from its domelike appearance.

143. An isolated hill, with cliffs on its eastern face: Sq!u'l'ats, "dirty face." This hill is where lived the aged grandmother of young South Wind. After her people were driven away, she became very poor, and her face became dirty. This explains the mottled appearance of the cliffs. The river sweeps along the base of this elevation.

TIDES IN THE BAY OF FUNDY

By H. A. MARMER

U. S. Coast and Geodetic Survey, Department of Commerce

The greatest known rise and fall of tide occurs in the Bay of Fundy, the arm of the Atlantic that separates the Canadian province of Nova Scotia from its sister province of New Brunswick and from the State of Maine. At its head the Bay of Fundy forks into two inlets, in the southern one of which, Minas Basin, the tide rises a vertical distance of from forty to fifty feet in a period of six hours and falls the same distance in the following period of six hours.

That the tide in the Bay of Fundy is characterized by a very considerable rise and fall has been known for many years. In some of the older publications, however, the figures given for this rise and fall appear to have been affected by a "factor of dramatic effect." As an example, we find in the Astronomy of Sir John Herschel[1] the statement that "in some places the tide-wave, rushing up a narrow channel, is suddenly raised to an extraordinary height. At Annapolis, for instance, in the Bay of Fundy, it is said to rise 120 feet." As given in the tide tables[2] the rise and fall of the tide at Annapolis is, on the average, 25 feet increasing to 29 feet at times of spring tides.

In the upper parts of the Bay of Fundy, in consequence of the great range of the tide, the shores at low water present a bare appearance, exposing to view wide expanses of mud flats. This condition greatly affects communication by water. "As regards navigation, the numerous small steamers in the upper part of the bay have to make their calls at high water and leave promptly, as all the wharves dry at about half tide. Schooners are accommodated by lying on a bench of mattress-work, against the wharves, while the tide is down."[3]

The configuration and hydrographic features of the Bay of Fundy are shown in Figure 1, which is based on Chart No. 1412, issued by the U. S. Hydrographic Office. The mouth of the bay, defined by a line drawn from Jebogue Point on the south to Point of Main on the north, has a width of 76 geographic miles and an average depth of 280 feet, reckoned from mean sea level. At Cape Chignecto, where the bay forks, the width is 25 miles and the average depth 130 feet, and above Cape Chignecto the contraction in width and shallowing in depth take place even more rapidly.

It is to this gradual narrowing of the bay and its lessening depth from mouth to head that the very considerable rise and fall of the tide in the

[1] J. F. W. Herschel: Outlines of Astronomy, 6th edit., London, 1859, p. 531.

[2] Tide Tables, United States and Foreign Ports, for the year 1922, *U. S. Dept. of Commerce Serial No. 163*, U. S. Coast and Geodetic Survey, Washington, D. C., 1921, p. 335.

[3] W. B. Dawson: Tides at the Head of the Bay of Fundy, Ottawa, 1917, p. 3.

upper reaches had generally been ascribed. "The greater rise of the tides in the upper part of this bay is attributed to its narrowing funnel form, and its shallowing bottom cooping up the tidal wave as it advances up the bay."[4]

The Range of the Tide

The extent of the rise and fall of the tide, or more precisely, the range of the tide, increases from the mouth of the bay to its head. Taking the Nova

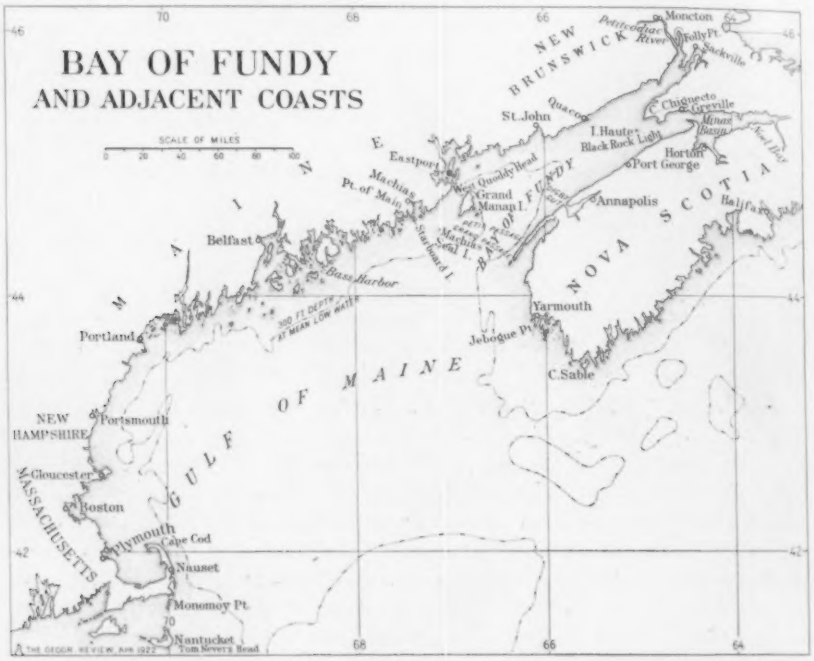

FIG. 1

Scotia shore, we have a mean range of 9.1 feet at Cape Sable, 14.0 feet at Yarmouth, 18.2 feet at Grand Passage, 24.1 feet at Digby Gut, 27.8 feet at Port George, 31.5 feet at Black Rock Light, 42.0 feet at Horton Bluff and 44.2 feet in Noel Bay.[5] At times of new and full moon, when the so-called spring tides occur, the range of the tide is about 14 per cent greater, and at such times the tides in Noel Bay have a rise and fall of about 50.5 feet.[6]

On the north shore a similar condition prevails, the range of the tide

[4] Robert Chalmers: Report on the Surface Geology of Eastern New Brunswick, Northwestern Nova Scotia, etc., Report M of *Ann. Rept. Geol. Survey of Canada*, Vol. 7 for 1894, Ottawa, 1895, p. 16.

[5] Tide Tables . . . 1922, p. 335.

[6] *Ibid.*, p. 335.

increasing from the mouth of the bay to its head. This increase becomes even more striking if we begin with the tide at Tom Nevers Head on Nantucket Island and go up the coasts of Massachusetts, New Hampshire, Maine, and New Brunswick, which form the western and northern shore of the Gulf of Maine and Bay of Fundy. For the mean range of the tide we have 1.2 feet at Tom Nevers Head, 3.7 feet at Monomoy Point, 6.0 feet at Nauset Harbor, 8.9 feet at Gloucester, 10.2 feet at Bass Harbor, 15.7 feet at West Quoddy Head, 20.9 feet at St. John, 26.3 feet at Quaco, 39.4 feet at

FIG. 2—Low water, mouth of Petitcodiac River, Bay of Fundy. Government Wharf, Hopewell Cape. Folly Point seen in the distance. At spring tides the water falls about 13 feet lower than is seen here. (Courtesy of Canadian Tidal and Current Survey).

Folly Point, and 41.2 feet at Moncton.[7] Here likewise the spring range of the tide is about 14 per cent greater than the mean range.

It is evident that the effect of the converging shore lines and gradual slope of bottom tends to increase somewhat the range of the tide in the upper parts of the bay. But it is likewise evident that these features cannot be wholly responsible for the increase in range from less than 10 feet at the mouth to more than 40 at the head. There is involved some factor other than the "cooping up of the tidal wave as it advances up the bay." For in many other bays we have somewhat similar features without anything like corresponding increases in range of tide. Thus at the mouth of Delaware Bay we have a mean tidal range of 4.7 feet; and at Philadelphia,

[7] *Ibid.*, pp. 335–338.

where the cross section of the tidal waterway has decreased very considerably, the range of the tide is but 5.3 feet.[8]

A close examination of the ranges of the tide brings to light the fact that, relative to the axis of the bay, a point on the southern shore has a greater range of tide than the corresponding point on the northern shore. Thus the tide tables give as mean ranges of the tide 14.0 feet for Yarmouth against 12.9 feet at Starboard Island; 19.3 feet in Petit Passage against 15.7 feet at West Quoddy Head; 27.8 feet at Port George against 26.3 feet at Quaco.[9]

This increase in the range of the tide on the southern shore is brought about by the rotation of the earth, in consequence of which all moving bodies are impressed with a force deflecting them to the right in the northern hemisphere and to the left in the southern hemisphere. On the flood tide the water entering the Bay of Fundy is deflected to the right or southern shore; hence high water here is raised somewhat higher than on the northern shore. On the ebb tide the moving water is again deflected to the right; but now it is the northern shore that is to the right of the moving water, and hence low water is somewhat higher on the northern than on the southern shore. The tide therefore rises higher and falls lower on the southern shore, giving a greater range here than on the northern shore.

Rate of Rise and Fall

In its rise and fall the tide does not move at a uniform rate. Beginning at low water the rise at first takes place very slowly but at a constantly increasing rate, so that about three hours after low water the tide has acquired its greatest rate of rise. From this time the rise begins to take place at a constantly decreasing rate until high water is reached. A similar cycle then begins in the falling direction, the rate of fall increasing gradually for about three hours, when it is greatest. The tide then continues its fall at a constantly decreasing rate until low water is reached.

If the rise and fall of the tide be represented graphically by plotting the height of the water at successive intervals of time, say every half hour or hour, the curve of the tide will approximate the well known form of the sine or cosine curve. This is brought out in the accompanying diagram of the rise and fall of the tide on August 13, 1862, at Eastport, Maine, on the northern shore of the Bay of Fundy. The curve was drawn by plotting the heights of the tide at every half hour as determined from an automatic tide gauge record.

The variations in the rate of rise and fall of the tide from low water to high water and from high water to low water stand out clearly in the diagram. The most rapid rise takes place midway between low water and high water, and the most rapid fall midway between high water and low water;

[8] Tide Tables . . . 1922, p. 344.
[9] *Ibid.*, pp. 335–336.

FIG. 3

FIG. 4

FIG. 3—Low water, mouth of Petitcodiac River, Bay of Fundy. Government Wharf, Hopewell Cape. (Courtesy of Canadian Tidal and Current Survey.)

FIG. 4—High water, mouth of Petitcodiac River, Bay of Fundy. Government Wharf, Hopewell Cape. High tide occasionally covers the wharf shown here. (Courtesy of Canadian Tidal and Current Survey.)

and in both cases this is about three hours from the time of high or low water.

From the theory of the cosine curve we find likewise that the most rapid change of elevation takes place midway between the highest and lowest points; and it is of interest to compare the theoretical rate of most rapid rise or fall with that determined from actual observations. From Figure 5 we find that from 7:40 A. M. till 1:45 P. M., that is in a period of 6 hours and 5 minutes, the tide rose a total distance of 21.1 feet, with the most rapid rise occurring between 10 and 11 A. M., when the elevation changed by 5.0 feet. For a range of 21.1 feet in six hours and five minutes, the theory of the cosine curve gives 5.4 feet as the greatest change in elevation during one hour. The close agreement between the actual rise of 5.0 feet and the computed rise of 5.4 feet for a true cosine curve shows that the tide curve for Eastport does not deviate much from the cosine curve.

The rate of rise or fall of the tide evidently depends on the total rise and fall of the tide, increasing in direct proportion to the total range. In 1916 in the vicinity of Noel Bay, W. Bell Dawson[10] measured a rise of 11.2 feet per hour occurring with a tide that had a total rise of 49.7 feet in a period of six hours and one minute. The theoretical most rapid hourly rise in a true cosine curve of the same range is 12.8 feet. In this connection it may be of interest to note that sixty years ago one of our encyclopedias had it that the Bay of Fundy was "remarkable for its extraordinary tides which rush up from the sea with such rapidity as sometimes to overtake swine feeding on shellfish on the shores."[11]

Time of Tide

In most bays and rivers the time of tide becomes later, in going upstream, at a rate dependent on the depth of the tidal waterway. Thus in Chesapeake Bay the time of tide at Turkey Point Light, which is about 165 geographical miles above the mouth of the bay, is 12 hours later than at Cape Charles Quarantine.[12] This gives the tidal wave a rate of advance of 13¾ geographical miles per hour.

The relation existing between the time of tide in the upper and lower reaches of a bay, such as Chesapeake Bay or Delaware Bay, is given approximately by the formula, $v = \sqrt{gh}$ where v is the velocity of the tidal wave, g is the acceleration of gravity, and h is the average depth of the tidal waterway. Applying this formula to the stretch of Chesapeake Bay from Cape Charles Quarantine to Turkey Point Light, we find, since the value of g for the latitudes of Chesapeake Bay is 32.15 feet per second, a value for h of 17 feet. This is an approximation to the average depth of that stretch of the bay.

[10] Dawson, *op. cit.*, p. 10.
[11] New American Cyclopaedia, New York, 1858–1863, Vol. 8, p. 11.
[12] Tide Tables . . . 1922, pp. 345–346.

If we examine the times of tide in the Bay of Fundy we find a totally different state of affairs. While the time of tide becomes somewhat later in going upstream, this retardation in time is quite inconsiderable and has no such relation to the depth of the tidal waterway as given in the formula above. Thus from Machias Seal Island, near the mouth of the Bay, to Isle Haute about 77 miles upstream the difference in time of tide is but four minutes.[13] This gives a velocity for the tidal wave of 19¼ miles per minute, which, in the formula connecting the velocity of the tidal wave with the depth of the tidal waterway that holds good for most bays and rivers, gives the impossible depth of over 100,000 feet. The average depth of the bay from Machias Seal Island to Isle Haute is approximately 200 feet.

Throughout the whole length of the bay the time of tide differs but little. From Grand Passage to Noel Bay at the upper end, a distance of 132 miles, the tide becomes later by only 1 hour 39 minutes, giving for the tide a rate of advance of 1⅓ mile per minute, which in the formula connecting depth and velocity results in a depth of almost 600 feet.

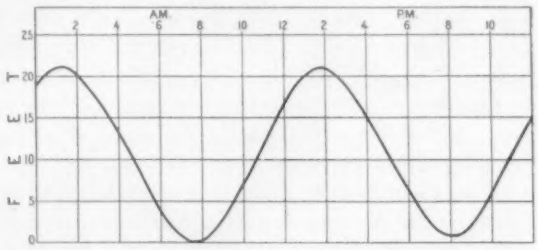

FIG. 5—Tide curve, Eastport, Me., August 13, 1862.

RELATION OF CURRENT TO TIDE

In so far as the time of tide is concerned it is evident that the tidal movement in the Bay of Fundy is quite different in character from that obtaining in Chesapeake Bay and in most bays and rivers. Further light on the character of this tidal movement may be obtained from a consideration of the tidal currents that accompany the rise and fall of the tide. From low water to high water an enormous quantity of water passes from the sea into the bay; and in the fall of the tide from high water to low water this vast amount of water passes out again to the sea. We may therefore expect tidal currents having considerable velocities.

From observations made over a considerable stretch of the Bay of Fundy by W. Bell Dawson,[14] we find that the current stopped flooding about one hour after local high water and ebbing about an hour after low water. The strength of the flood current came about two hours before high water and the strength of the ebb current two hours before low water.

If we examine the relation obtaining between tide and current in a tidal

[13] Tide Tables for the Eastern Coasts of Canada for the Year 1921, Canadian Tidal and Current Survey, Ottawa, 1920, p. 13.

[14] W. B. Dawson: Tables of Hourly Direction and Velocity of the Currents and Time of Slack Water in the Bay of Fundy, etc., Ottawa, 1908.

waterway like Chesapeake Bay, we find that the strength of the current comes about the time of high or low water and slack water about three hours before high or low water. Whereas in the Bay of Fundy the current was running swiftest about midway between high and low water, in Chesapeake Bay the current is slack at that time; and the relation obtaining between tide and current in Chesapeake Bay is the one that characterizes most bays and rivers.

Types of Tidal Movements

The differences that distinguish the times of the tide and the relation of tide to current in the Bay of Fundy from those in Chesapeake Bay arise from the fact that the tidal movements in these two bays are of different types—illustrating, in fact, the two principal types of tidal movements.

In Chesapeake Bay it was seen that going upstream the tide became progressively later from place to place. This is the "progressive wave" type. From theoretical considerations of this type of movement it follows that the rate of advance of the tide is a function of the depth and that in a uniform channel the range of the tide tends to decrease in going upstream. Furthermore, the current that accompanies the rise and fall of the tide should have its greatest velocity about the time of high and low water, slack occurring midway between high and low water.

This progressive wave type of movement is illustrated on a smaller scale by the ordinary wind waves with which we are familiar along the coast and in inland waters. If for the moment we call the crest of such a wave high water and its trough low water, it is evident that when this wave travels over a body of water the times of high and low water will progress regularly from one end to the other end of the body of water.

A wave of a totally different kind may also be made to travel through a body of water. Suppose we have a vessel, say a rectangular tank, partly filled with water: if we raise and then immediately lower one end, a wave will be started which puts into oscillation the whole body of water. But it will be noticed that high water will occur at one end when it is low water at the other end and that, for the body of water as a whole, high water will occur simultaneously for one half at the same instant that it is low water for the other half. This kind of movement is known as the "stationary wave" type.

If we examine the simple stationary wave movement as exemplified in a rectangular tank of water, we notice that the rise and fall of the water is nil at the middle and greatest at the ends, the range increasing from the middle to the ends. Furthermore, the horizontal motion of the water ceases at the time of high water and is greatest midway between the times of high and low water. This is brought out in Figure 6, which shows in diagrammatic form the positions of the surface of the water at the instants of high water and low water at each end.

When the surface of the water is in the position indicated by the line A B, it will be low water for half of the tank from A to M and high water for the other half from M to B. And later, when the surface of the water has assumed the position C D, it will be high water from C to M and low water from M to D. At M therefore the water neither rises nor falls; and the extent of rise and fall increases with the distance from M, so that at the two ends the rise and fall is greatest.

From the characteristics of the tidal movement in the Bay of Fundy, it is evident that we have here an example of the stationary wave type, in which the bay behaves approximately as one half of the rectangular tank of water shown in Figure 6. From the mouth to the head the time of tide is nearly simultaneous, the rise and fall increasing with the distance from the mouth.

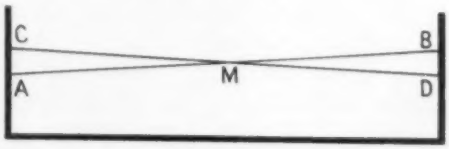

FIG. 6

A reason for the increased range of the tide in the upper reaches of the bay is therefore found in the character of the tidal movement. If we turn to other bodies of water in which the tidal movement is of the stationary wave type we shall likewise find an increase in the range of the tide from mouth to head. Thus in Long Island Sound, over the greater portion of which the tide is of the stationary wave type, the rise and fall of the tide increases from 2.0 feet at Montauk Point to 7.2 feet at Willets Point.

A further increase in the rise and fall of the tide at the upper end of the Bay of Fundy takes place because of the very considerable contraction in width and shallowing in depth. This increase in the range of the tide on account of decreased cross section takes place in both the stationary and progressive wave types of tidal movements. But even the co-operation of the causes adduced does not yet satisfactorily account for the enormous ranges of the tide found in the Bay of Fundy. A still further cause has been discovered somewhat recently in the period of oscillation of the water in the bay as a whole.

PERIOD OF OSCILLATION

If we start stationary waves in tanks of various lengths filled with water to different depths, it will be found that the time taken for a wave to travel from one end of the tank to the other, that is the period of the wave, depends only on the length of the tank and the depth of the water. In other words, for each body of water there is a natural period of oscillation which is a function of the depth of the water and the length of the basin in the direction of oscillation; and, if it is desired to maintain the stationary wave movement in our tanks of water, it is only necessary to apply a slight force, at intervals, to the tanks. But it will be found that if the force is applied at regular intervals, the rise and fall of the water in the tanks will be con-

siderably greater; and if the force be applied to the different tanks at regular intervals which in each case coincide with the natural periods of the different tanks, we shall have the maximum rise and fall of the water in each tank.

In inclosed bodies of water the stationary wave type of movement has been known and studied under the name of "seiche" since the time of F. A. Forel,[15] who began his researches on the Lake of Geneva in the early seventies of the past century. The mathematical theory has been developed to a high degree, especially by Chrystal,[16] who has made it applicable also to irregularly shaped basins. But nothing had been done in regard to bodies of water opening at one end into a very much greater basin, as exemplified by bays connected with the ocean.

In 1908 there appeared, independently, two publications in which the oscillation of bodies of water open at one end was treated. R. A. Harris,[17] of the U. S. Coast and Geodetic Survey, investigated the matter in connection with his tidal studies; and, in Japan, Honda, Terada, Yoshida, and Isitani[18] were led to the investigation in connection with earthquake studies. From these investigations it developed that bodies of water opening at one end into larger basins are capable of sustaining stationary wave movements of the character exemplified by the movement of the water in half of the tank, Figure 6, the formula for the period of oscillation in a rectangular basin of uniform depth being approximately $T = \sqrt{\frac{4L}{g\,h}}$ where T is the period of oscillation, L the length of the basin, g the acceleration of gravity, and h the depth of water.

It would appear reasonable to suppose that the width of the mouth of a bay has some influence on the period of oscillation; and such in fact the Japanese investigators found to be the case. By introducing a factor to take account of the width of the mouth, the approximate formula above becomes more exactly

$$T = \frac{4\,L}{\sqrt{g\,h}} \sqrt{1 + \frac{2}{\pi}\frac{b}{L}\left(0.9228 - \log_e \frac{\pi}{4}\frac{b}{L}\right)}$$

where b is the width of the mouth of the bay, π and e having the usual significance.[19]

It is evident that, in computing the natural period of oscillation of the Bay of Fundy, the length of the bay and also its width will vary in accordance with the limits assigned to the bay; and this in turn will affect the value of the mean depth of the bay. Thus Honda and his colleagues[20]

[15] Forel's studies are summarized in his "Le Léman," Lausanne, 1892–1904, Vol. 2, pp. 39–213.

[16] George Chrystal: On the Hydrodynamical Theory of Seiches, *Trans. Royal Soc. of Edinburgh*, Vol. 41, 1903–05, pp. 599–649.

[17] R. A. Harris: Manual of Tides, Part V, Appendix 6 of *Rept. of the Supt. of the Coast and Geodetic Survey for 1906–1907*, Washington, D. C., 1907, pp. 467–482.

[18] K. Honda, T. Terada, Y. Yoshida, and D. Isitani: Secondary Oscillations of Oceanic Tides, *Journ. College of Sci., Tokyo Imp. Univ.*, Vol. 24, 1908, pp. 1–110.

[19] See Otto Krümmel: Handbuch der Ozeanographie, Vol. 2, Stuttgart, 1911, p. 16.

[20] Honda, *op. cit.*, p. 106.

found that by taking the mouth of the bay from Cape Sable to Cape Cod and the end of the bay at Port Greville, the period of oscillation was 13.0 hours; while by taking the mouth from Yarmouth to Machias the period of oscillation came to 11.6 hours. Taking the bay as extending from Grand Manan Island to Sackville, Krümmel[21] derived a value of 12.46 hours. It is to be noted, however, that, while the value of the period of oscillation varies with the limits assigned to the bay, this value in every case approximates 12½ hours.

Now the mean value of the period of the tide is 12 hours 25 minutes, or 12.42 hours. We find, therefore, that the natural period of oscillation of the Bay of Fundy approximates very closely to the period of the tide. It appears, therefore, that the tides in the Bay of Fundy may be regarded as stationary wave oscillations of the whole body of water, the motion being sustained by the periodic ocean tide at the mouth of the bay. As we found in the case of our tanks of water, this oscillation is greatest when the period of the sustaining force is the same as the natural period of oscillation of the body of water.

It may, therefore, be concluded that the tidal phenomena in the Bay of Fundy are due primarily to the fact that the natural period of oscillation of the bay closely approximates the period of the ocean tide. This brings about a stationary wave movement with the greatest possible rise and fall of the water for the existing geographic features of the bay. In the upper reaches of the bay the range of the tide is further increased because of the considerable diminution of cross section brought about by the contraction in width and shoaling of bottom. The fact that some retardation in the time of tide occurs towards the head of the bay shows that there is some progressive wave movement present.

No account of the tide in the Bay of Fundy would be considered complete without at least a passing reference to the bore in the Petitcodiac River, at the head of the northern fork of the bay. Through a portion of this river the flood tide comes as a wall of broken and foaming water having "a height of perhaps two or three feet."[22] This striking phenomenon is brought about by the resistance offered to the incoming tide by the river current and by the shallow and contracted channel at low water. A careful description of the bore has been given by W. Bell Dawson.[23]

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[21] Krümmel, *op. cit.*, p. 319.
[22] W. B. Dawson: Survey of Tides and Currents in Canadian Waters, Ottawa, 1899, p. 23.
[23] *Ibid.*, pp. 22–25.

THE FORESTS OF THE DOMINICAN REPUBLIC*

By William Davies Durland

The visitor to the Dominican Republic who will forsake the historic towns and cities of the more populous seaboard for the less frequented highways and byways of the sparsely settled interior gains a profound impression of the country's forestal resources. Trees line the *Caminos reales* and extend in a mass of entangled foliage, vines, ferns, epiphytes, cacti, and tree trunks for miles and miles up the valleys and on the mountain slopes to the fern-clad summits of the highest altitudes. If the traveler come by way of Porto Rico this impression of luxuriant vegetation will be still deeper by contrast, for, though only 70 miles distant to the east, this densely populated island is very sparsely forested as the result of native waste and despoliation.[1] Least known of the Greater Antilles, Columbus's island of Hispaniola has been least changed since pre-Columbian times. At least 75 per cent of the land area is still forest-clad with trees that can be classed as timber. The area of the entire island is over 28,000 square miles, of which approximately two-thirds pertains to the Dominican Republic.

Physiographic Divisions

The republic in general presents a rugged appearance: mountain ridges of varying height separate rather extensive plains and enclose broad fertile valleys. In the northern part the ranges and valleys have a general west-northwest trend related to the trend lines of eastern and central Cuba; in the southern part the trend is east and west in line with the major axis of Jamaica. The relief is known only in broad and approximate outline; some parts of the country, indeed, are absolutely unknown. However, under United States supervision topographical and geological surveys have been begun and a tentative classification into physiographic provinces is available.[2]

The Cordillera Central, commonly known as the Sierra de Cibao, the principal mountain range, divides the country into two parts. It is described as a "jumble of ridges and peaks" whose extreme irregularity is to be explained by complex geological composition and structure.[3] Several peaks of the main ridge attain elevations of 8,000 and 9,000 feet. The Cordillera

* Acknowledgment is made of the assistance of Professor H. N. Whitford, School of Forestry, Yale University, in the preparation of this paper and to Professor S. J. Record of the same school for identification of the wood samples collected by the author.

[1] L. S. Murphy: Forests of Porto Rico, Past, Present, and Future, *U. S. Dept. of Agric. Bull. No. 354* (Contribution from the Forest Service), Washington, D. C., 1916.

[2] T. W. Vaughan, Wythe Cooke, D. D. Condit, C. P. Ross, W. P. Woodring, and F. C. Calkins: A Geological Reconnaissance of the Dominican Republic (Geological Survey of the Dominican Republic, Memoirs, Vol. 1), Washington, D. C., 1921.

[3] *Ibid.*, p. 31.

Septentrional, or Monte Cristi range, follows the northern coast line from the base of the Samaná peninsula to Monte Cristi. The range is highest in the center north of Santiago where some peaks rise to elevations of 3,000 or 4,000 feet. The Samaná peninsula, which is considered a separate physiographic province, is also mountainous, reaching heights of 1,500 feet in the center. In the southwestern part of the republic the Sierra de Bahoruco extends from the province of Barahona into Haiti. The ridges with crest summits of 3,000 to 5,000 feet are intersected by valleys with local savanas. Two small ranges of hills, known as the Sierra de Martín García and the Sierra de Neiba, lie slightly further north, the former extending from the Caribbean Sea westward to the Sierra de Neiba, from which it is separated by the Rio Yaque del Sur. The Sierra de Neiba extends in a westerly direction into Haiti.

Between the central and the northern ranges lies the Valle del Cibao, the eastern portion of which, the Vega Real, is not only the largest and richest valley of the country but is described as "among the most impressively fertile districts in the world."[4] In the southern half of the republic similar but less extensive valleys lie between the various ranges, while in the eastern section between the main range and the sea are level regions that may be called plains. That part east of the Rio Jaina is known as the Seibo plain, or "Eastern Valley," a more humid region of forests and savanas; the western part is known as the plain of Baní and is drier, needing irrigation for its extensive crops. The plain of Azua is still drier, as is also the curious low-lying basin of Lake Enriquillo. Between the Sierra de Neiba and the central cordillera is the interesting Valle de San Juan, to be described later. Such is the abundant water supply of the country as a whole—a direct consequence of the high relief—that water for irrigation is almost everywhere plentiful. Except for one or two arid spots in the western portions it would be impossible to travel any distance in Dominican territory without encountering a stream or brook.

Temperature and Rainfall

Although the Dominican Republic lies entirely within the tropics—approximately between latitudes 20° and 17° 30′ N.—the tropical climate is to a great extent tempered by the mountainous character of the country. In the lowlands of the coast the breezes cool the air the year round, blowing from the sea during the day and from the land after sundown: it is only the low, enclosed valleys that are excessively hot. Few actual meteorological records are available; in fact, on the entire island of Santo Domingo the only place from which a long continuous series of records is available is Port au Prince in the Haitian Republic. Port au Prince, however, is not far from the border, and the temperature regimen of that city may be taken as fairly typical, although the town because of its sheltered situation appears

[4] *Ibid.*, p. 29.

FIG. 1—Map of the Dominican Republic showing relief and communications. Scale approximately 1 : 2,750,000. The inset map shows the entire island of Haiti or Santo Domingo in relation to contiguous territory. Scale 1 : 11,000,000.

Santo Domingo in relation to contiguous territory. Scale 1 : 11,000,000.

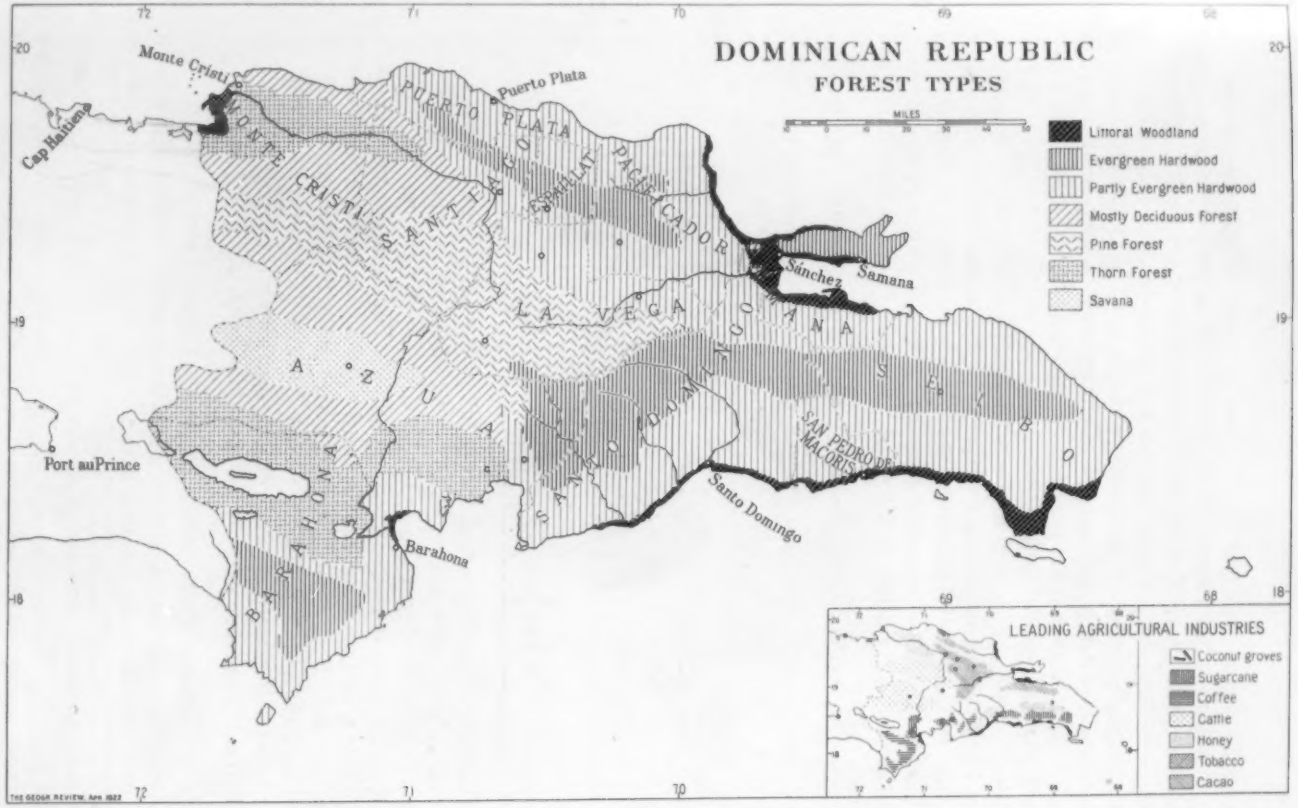

FIG. 2—Map showing the forest types of the Dominican Republic. Compare with the relief map (Fig. 1) opposite. Scale approximately 1 : 2,750,000. The inset map shows broadly the areas in which the chief agricultural industries are being carried on. Scale 1 : 11,000,000.

to be somewhat unduly hot. The mean annual temperature is 79° F., ranging from 82° in July to 75° in January, the mean maximum being 98° and the minimum 61°.[5] At Santo Domingo City where the U. S. Weather Bureau maintained a station from 1898 to 1900 the mean temperature was 77°, ranging from 80° in August to 74° in January and February, the absolute maximum being 95° and the minimum 59°.[6] Closely similar are the records for the three-year period (1886–1888) at Sánchez, Samaná Bay—mean 76.8°; range 80° to 73°.[7]

Two seasons, winter and summer, are usually distinguished, the distinction being in large measure a question of precipitation. From the month of March to October rains are usually abundant, and from November to February the season is generally known as dry. This is well illustrated in the cases of Santo Domingo City and Sánchez.[8] Points in the interior and

TABLE I—MEAN ANNUAL PRECIPITATION AT STATIONS IN SANTO DOMINGO
(*In inches*)

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Santo Domingo City (5 years)	2.0	0.9	2.1	6.8	6.2	7.4	8.3	6.7	7.6	9.6	2.7	2.1	62.9
Sánchez (7 years) .	3.8	3.2	4.0	5.0	6.4	7.8	8.3	8.8	5.8	5.2	8.3	4.0	70
La Vega (7 years) .	4.6	3.6	3.3	5.6	7.6	6.8	7.2	4.0	4.8	6.8	10.0	2.8	67
Port au Prince (39 years)	1.1	2.3	3.7	6.5	9.7	4.1	2.9	5.3	7.5	7.0	3.5	1.3	55

the west show a tendency towards two rainy seasons. This tendency is apparent at La Vega and is well marked at Port au Prince. A number of observations from such a dry region as the lower valley of the Yaque del Sur show at least 20 inches of rain at every station. At Barahona the annual mean is 41 inches with two rainy seasons, April to mid-June and late September to the end of October.[9] On the northern coast of Santo Domingo, on the contrary, the winter months are the rainiest.[10] Differences of rainfall on windward and leeward slopes in conjunction with great topographic irregularity cause pronounced local variations in climate.

THE GENERAL RELATIONS OF THE FOREST VEGETATION

Almost without exception the mountain ranges are covered with a forest growth and a sub-vegetation which together form a continuous canopy.

[5] Julius Hann: Handbuch der Klimatologie, Stuttgart, 1910, Vol. 2, p. 353.

[6] Observations quoted by Otto Schoenrich: Santo Domingo, New York, 1918, p. 128.

[7] Hann, Vol. 2, p. 348.

[8] C. E. P. Brooks: The Rainfall of San Domingo, *Meteorol. Mag.*, Vol. 56, 1921, pp. 73–74. [Rainfall at stations in the eastern half of the Cibao Valley.]

[9] T. W. Vaughan, etc.: A Geological Reconnaissance of the Dominican Republic, p. 197.

[10] See the statistics of rainfall at Puerto Plata and at points on the northern coast of Haiti in *Bull. Ann. de l'Observatoire Météorologique du Séminaire-Collège St. Martial*, Port au Prince, Haiti.

As a whole, these forests are very similar in character and composition to other tropical forests of the Antilles. Compared with Porto Rico and Cuba their resemblance is very close, with the exception of the pine forest which seems to have gained a superior foothold in the Dominican Republic.

Concerning the forest vegetation of this republic very little is known from a technical standpoint. It is evident that for many years the properly called "gold nuggets" of the forest have been cut out by dyewood and cabinet-wood seekers, both native and foreign, and the qualities of these woods are exceedingly well known. Satinwood, mahogany, fustic, logwood, ebony, pencil cedar, and lignum-vitae are the better known of these woods, and they have been exported in considerable quantity since trade first began with the republic. Outside of these well-known woods of commerce and a few others, there is very little knowledge to be had concerning the scientific identity and the technical uses of the remaining species of the forests. Hand specimens of a number of the native Dominican woods have been collected, and the identity of some of these has been established. A more or less complete list of the tree species to be found in the republic is included in the appendix to this article. At the present time there is great need for a botanical exploration of the forests.

All who are acquainted with the general character of tropical forests are aware that from the standpoint of the botanist they are exceedingly complex in composition. Contrasted with the temperate regions the great majority of the species are woody—either trees or woody vines. Furthermore, the tree species of the forests, because of their inherent tendencies, usually arrange themselves into successive stories or floors of varying and irregular heights which differ from the type of forest in which they are growing. Where the climatic and soil factors approach the best conditions for forest growth, the lower story is composed of tree species whose crowns, when mature, form the first story; towering above this at more or less regular intervals are the crowns of the species which go to make up the second story. The uppermost stories include the tallest trees of the stand and contain, comparatively speaking, fewer species than either of the first two stories.[11]

The writer has prepared a forest-type map showing the broad relations of the forest vegetation, and a general discussion of this map is to be found on the succeeding pages. The information upon which the construction of this map is founded was secured by numerous reconnaissance surveys over the entire republic extending throughout a period of nearly two years. It was collected en route from place to place over established trails; and as such it is, at best, only general. All the type division lines are more or less arbitrarily established, as no location measurements were taken. Accordingly there exists a wide variation between the actual and the platted locations of these types. The inset agricultural map is based on information collected during the same surveys; and, as such industry is correlated with

[11] Compare H. N. Whitford: Forest Conditions of Colombia and Venezuela, *Bull. Pan Amer. Union*, Vol. 6, 1918, pp. 468–483.

forestry, it is included herewith. It is hoped that, notwithstanding its summary character, the map will serve as a nucleus around which a more systematic investigation of the forest resources of this republic will be made.

The forests of the Dominican Republic represent, according to the climatic and the edaphic-physiographic factors which have influenced their composition, the fundamental types established by ecologists with their corresponding divisions and gradations. They are as follows:

1. Evergreen Hardwood Forest
2. Partly Evergreen Hardwood Forest
3. The Pine Forest
4. The Thorn Forest
5. The Savana
6. The Mostly Deciduous Forest
7. The Littoral Woodland

The Evergreen Hardwood Forest Type

The evergreen hardwood forests occupy the zones of greatest rainfall. They cover (1) the eastern half of the upper slopes of the Cordillera Central, from the head of the Vanilejo and Nizao Rivers, eastward to the termination of the range on the seacoast in the province of Seibo and (2) the upper slopes of the Cordillera Septentrional, from the headwaters of the Saledo and Juba Rivers, southeastward to the vicinity of the Gran Estero and the upper reaches of the Boba River. This type of forest is also characteristically developed in the peninsula of Samaná, where the rainfall is heavy and more evenly distributed through the year than in some parts of the country. The central part of the province of Barahona, which embraces the upper slopes of the Sierra de Bahoruco from the higher elevations southeast of the city of Barahona to the headwaters of the Pedernales River, is also covered by this forest. Because it flourishes here on the upper slopes and hence under more temperate climatic conditions there is some modification of the distinctive tropical characteristics of the evergreen lowland forest of more torrid regions. There is a gradual reduction in the wealth of tropical forms and a decrease in the extent and development of many specifically tropical peculiarities—large-leafed foliage, planked buttresses, woody lianas and epiphytes, with storied under-forests of varying heights.

The individuals of these forests, as the classification indicates, are evergreen hardwoods which are hygrophilous in character. Collectively they are rich in thick-stemmed lianas and epiphytes and contain a wealth of aerial roots which descend vertically and unbranched through the air from the tree crowns. One of the striking features of these trees is the mosaic coloring of the bark, resembling that of the beech of the north temperate zone. The temperature and moisture conditions are more or less uniform throughout the year, extending the actual growing period of the species

within this type over the entire twelve months. It is here, as would be expected, that the most luxuriant forest growth of the republic is found. Within these forests there is displayed a dense mass of foliage from the ground up to the tops of the tallest trees, beneath which there is scarcely any direct sunlight and through which it is exceedingly hard to make one's way. Indeed this particular type of foliage is so dense that it is impossible, as has actually been proved by airplane observation, to see through it.

The composition of this forest is very complex; and, because of its location and the moist condition of its habitat, neither of which are favorable for any extensive exploitation of the forest, it is the least known. With the decrease in temperature attendant on an increase in altitude on ascending the mountain slopes, the characteristic stature of the composite species decreases in size. The majority of the species in this zone range in diameter from 10 to 25 inches. Very few larger trees are found here, whereas on the warmer lowlands, under proper conditions of moisture, the trees often reach a size of 36 inches in diameter and over.

FIG. 3—Evergreen hardwood type. An individual, showing the planked buttresses and the mosaic appearance of the bark resembling our northern beech.

Other descriptions of tropical rain forests of similar altitude in the islands and mainland borders of the Caribbean apply very well to the conditions found within this type.

THE PARTLY EVERGREEN HARDWOOD TYPE

In general the partly evergreen hardwood type represents the transitional stages of the forest growth between the typical evergreen hardwood type and the mostly deciduous type. In the case of the Dominican Republic, however, where owing to extreme topographic irregularity the diversity of climate over the entire forested area is great, this type appears rather as an independent formation than as a transition form. The type resembles to

some degree the monsoon forest of Schimper. Such transition forms have been described by Pittier for Panama and Venezuela.[12]

Compared with the evergreen hardwood type the tree life, because of climatic and soil differences, is much more varied. The temperature is higher and more uniform throughout the year. There is a seasonal change as regards the occurrence of precipitation, whence the numerous deciduous species present in the type composition. The forest is more or less open, occupied here and there by small rolling savanas or grasslands, many of which are probably due to the activities of man. There is a wide variation in the plant growth forms from gnarled, deformed shrubs or dwarf trees to lofty individuals, true giants of the vegetable kingdom. In places the trees are found in groups or small groves resembling the wood lots of our native pasture lands.

This type of forest occupies large areas but differs from the evergreen hardwood forests in being confined to the lower elevations between the mountain ranges and the seacoasts. It extends from the lower slopes of the Cordillera Septentrional and the Sierra de Bahoruco inland for a short distance, where it more nearly represents the transition stage mentioned above. This type practically surrounds the evergreen hardwood forest of the three largest ranges and occurs in a more or less continuous belt following the outline of the republic.

Much of the surface covered by this type has been cut over that the land might be used for agriculture. Many of the areas so cleared and cultivated according to the primitive methods of the *conuqueros* have long since been abandoned. Especially is this the case in the provinces of Santo Domingo, San Pedro de Macorís, and Seibo where, next to the valley of the Cibao, the population is the densest in the republic.

Many natural savanas also occur within the type, and it is often difficult to distinguish between these and the artificial openings made by man.

In the southwestern part of the province of Santo Domingo, lying wholly within this zone, particularly on calcareous soils in the valleys of the Ozama, Jaina, and Nizao Rivers and their tributary streams near the seacoast, are found large quantities of mahogany. Dominican mahogany is said to be excelled by none as to color, quality, and adaptability to fine furniture and cabinet work. Less of this wood is now secured than formerly. Considerable quantity of logwood was previously obtained also, but the supply today is practically exhausted. A fact worthy of note is the effort that is being made to produce a second growth of mahogany. Every farm, both large and small, within the area is protecting the young trees with the hope that they will bring a profit to their owners.

Many edible fruit-bearing species, undoubtedly introduced and planted by man, together with the highly utilized palms which find conditions best

[12] See for example H. Pittier: Our Present Knowledge of the Forest Formations of the Isthmus of Panama, *Journ. of Forestry*, Vol. 16, 1918, pp. 76–84; and Esbozo de las formaciones vegetales de Venezuela, Caracas, 1920, of which an abstract appears elsewhere in this *Review*.

FIG. 4

FIG. 5

FIG. 6

FIG. 4—Evergreen hardwood type. A stand of cigua and cabilma on the La Vega-Santo Domingo highway This timber is equal to any American hardwood in quality.

FIG. 5—Evergreen hardwood type. Forest in the vicinity of Guananito, province of Santo Domingo. The first and second storied trees have been removed as the first step in clearing the land.

FIG. 6—Partly evergreen hardwood type. A *conuco* clearing in the vicinity of San Cristobal, province of Santo Domingo. Smaller trees are first cut and burned followed by the larger trees, which if not burned are left to rot where they fall. After three or four crops have been raised the area is abandoned.

adapted for their growth within this type also, are prominent in its present composition.

From the standpoint of the lumberman this forest is better known than the one previously described because it supports the growth of many of the heretofore much-sought-for "gold nuggets" of the tropics.

The Pine Forest Type

The pine forest of the Dominican Republic is of more interest commercially than all of the other forest types put together. This can be explained perhaps by the fact that pine lumber has long been used and is well-known, chiefly because foreign pine has been extensively imported for general construction purposes. The species is resinous and heavy, barely floating in water. In past years a few attempts have been made to exploit this pine, but operations have been on a small scale and of a temporary nature. The still unsettled status of land ownership[13] and the previous unstable conditions of the native government have made exploitation as a business enterprise practically impossible, whence the lack of development of what is considered to be a domestic source of construction lumber and the unmolested condition in which this pine is found.

The boundaries of the pine forest are usually sharply defined. As a type it occupies the northern slopes of the main range from the vicinity of Cotui west to the Haitian border. Botanically the formation is not complex, 80 per cent and over of the surface area being covered by one species of pine identified as *Pinus occidentalis*. In appearance the type somewhat resembles the open parklike stands of pine in our own southern states though it is far less abundant per acre. It ranges in diameter on the average from 12 to 25 inches breast-high and in total tree height from 40 to 60 feet. Eggers reports that at the higher elevations (4,000 feet) individuals approaching 200 feet in height and 4 feet or more in diameter are not uncommon.[14] The trees are scattered more or less singly over the area in a very open manner, on the ridges in particular. They are found at times, although exceptionally, in dense pure stands. A luxuriant growth of wild grass over which cattle graze at will forms a ground cover beneath the pine. This ground cover is coincident with the occurrence of the pine and is characteristic of the type. A good picture of the pine forest landscape is given by Gabb in his description of the Constanza Valley on the southern border of the pine zone.

> There is not a spot in Santo Domingo less tropical in appearance than the Valley of Constanza. The settlement of a dozen houses is in the midst of the woods. There is not a palm, plantain, or other tropical-looking plant in sight. The frowning black mountains, shutting in the valley on all sides; the tall columns of the pine trees, with the prostrate trunks and yet solid stumps of their fallen brethren; the little houses, encircled with split rail-fences and bargates; the browsing cattle, horses, and sheep, and above all the crisp morning air, so cold as

[13] Compare F. R. Fairchild: The Problem of Santo Domingo, *Geogr. Rev.*, Vol. 10, 1920, pp. 121–138.

[14] H. Eggers: Reise in das Innere von St. Domingo, *Petermanns Mitt.*, Vol. 34, 1888, pp. 35–41; reference on p. 36.

to condense one's breath into visible vapor, all point rather to the heart of the Sierra Nevada than to the interior of an island under the Cancer.[15]

The pine type is not found at all in Porto Rico. In Cuba it has a limited distribution occurring on certain rugged peaks of the Sierra Maestra at elevations not less than 1,800 feet above sea level.[16] The existence of the pine forest on such an extensive scale in the Dominican Republic is attributed to the simple operations of the *conuqueros* with their primitive methods of agriculture.[17] The continual cutting and burning of the original forest growth, which probably was an evergreen or partly evergreen hardwood

FIG. 7—A pine-clad slope in the vicinity of Jarabacoa, southwest of La Vega.

type, has destroyed the fertility of the soil to such an extent that it will no longer support the growth of these vegetative types. As a consequence the pine has been permitted to enter, perhaps from a lofty habitat where it naturally occurred on a small scale. In the absence of any competition and having the inherent capacity for growth on such soil, the pine has thrived and reproduced. The soil which practically supports the entire growth of pine is a reddish clay, or laterite, a fact which has been noted by Gabb.[18]

Evergreen and partly evergreen hardwood species mixed with pine are found in small, dense, thicket-like patches at the heads of many draws and in secluded valleys. The soil of these particular localities, in contrast to the laterite of the more exposed slopes and ridges, is composed of a dark rich

[15] W. M. Gabb: On the Topography and Geology of Santo Domingo, *Trans. Amer. Philosophical Soc.*, Vol. 15 (N. S.), 1872–80, pp. 49–259; reference on p. 133.

[16] B. E. Fernow: The High Sierra Maestra, *Forestry Quart.*, Vol. 4, 1906, pp. 239–273.

[17] O. F. Cook: Vegetation Affected by Agriculture in Central America, *U. S. Dept. of Agric. Bull. No. 145.*

[18] W. M. Gabb: Notes on the Distribution of the Vegetation of Santo Domingo, *Amer. Journ. of Sci.*, No. 102, Ser. 3, Vol. 2, 1871, pp. 127–129.

fresh loam. On such sites the pine, although a minor species in the composition, grows to a larger size and is a more healthy and vigorous tree.

Thorn Forest Type

Schimper states that "thorn woodlands are also richly developed in the Antilles." Similar types of vegetation have also been found in definite regions of the Dominican Republic where it is described by Harshberger as chaparral.[19] The great Cibao valley becomes progressively drier as one goes westward. A critical point is reached a little west of Santiago where the forest type of the Vega gives place to thorn forest. As the name indicates, this formation contains many species of trees and shrubs strongly armed with needle-like and piercing spines and prickles, so finely attached and arranged for defensive purposes that they seem to fly at one whenever within striking distance. The scenery has been compared with that of Lower California.

Fig. 8—The main street of a typical town of the Dominican Republic. The sides of the houses are made from boards cut from the highly utilizable palm.

The resemblance of this region to the arid plains of Lower California is very striking. The same dry soil covered with a scanty carpet of grass, the same low, straggling-limbed, open-foliaged acacia-trees: the same tall columnar cactus, with its undergrowth of *opuntias*, even the same cloudless sky, make the likeness complete.[20]

Another hot and semiarid area of thorn forest is found in the southwest, extending from the Bay of Neiba and including the plain of Azua westward through Haiti and including the depression of Lake Enriquillo. The gradually falling surface of this salt lake is now 144 feet below sea level, and the barrenness of the surrounding area is due rather to the salinity of the soil than to the scantiness of rainfall. Throughout the thorn-forest regions, in fact, the rainfall is not so scanty as the vegetation suggests, but most of the rain falls in the form of torrential showers, and the benefits from this precipitation are practically entirely lost through run-off. The soil composition has been found to be very desirable for agricultural purposes, but artificial irrigation is necessary. Lignum-vitae, logwood, and fustic are included in the valuable products of the thorn-forest regions.

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[19] J. W. Harshberger: Phytogeographic Survey of North America, *Die Vegetation der Erde*, Vol. 13, 1911, p. 681.

[20] W. M. Gabb: On the Topography and Geology of Santo Domingo, *Trans. Amer. Philosophical Soc.*, Vol. 15 (N. S.), 1872–80, pp. 49–259; reference on p. 157.

The Savana Type

The name of this formation usually implies grasslands intermingled with isolated plants and trees and an herbaceous growth, chiefly noticeable during the dry season of the year when it contributes a brownish, dried-up appearance to the landscape. The interior valley of San Juan which is more or less level and open, resembling a plain or prairie, presents such characteristics and is indicated on the vegetation map as comprising this type of formation. About 50 miles of the valley, which extends into Haiti, lies in the Dominican Republic and it is 10 to 12 miles wide. The soil is fertile, and there is more water for irrigation than in the adjacent plain of Azua; but this savana, rich in pasture land with a natural growth of succulent grasses and other herbaceous ground cover, is primarily devoted to cattle raising. Cattle are raised in almost every part of the republic; but in this valley, with San Juan as its chief commercial center, the industry is most favorably supported by the natural growth of the region and exceeds any development elsewhere. As in the case of the other types, detail information regarding the vegetation is lacking. However, as the Spanish name implies, it is not a timber-producing type, and the real forest vegetation other than shrubs and bush is widely scattered and of no significance in the general character of the formation.

The Mostly Deciduous Type

The savana type of the San Juan valley is encircled by a belt of tropical forest distinct in character from either of its bordering neighbors. It occupies an elevation corresponding to the low-lying range of hills known as the Sierra de Neiba, which naturally separates the formations mentioned, and the southern slopes of the western part of the Cordillera Central. At the most westerly end of the northern range or Cordillera Septentrional and surrounding the thorn forest in the northwestern part of the republic there is a similar forest type. Both are classified as mostly deciduous forests. The temperature of these areas is, on the whole, high and more or less uniform throughout the year. The climate is semiarid, the rainfall being limited and seasonal. The species of these forests are for the greater part xerophilous in structure and occur in a mixed type of vegetation which as a whole has drought-resisting characters. The information at hand is too inadequate to describe it in detail. It could very easily be included with the partly evergreen hardwood type although the deciduous species occur far more abundantly in the type under discussion.

Littoral Woodland Type

Two distinct types are here presented, as is the case with other littoral woodland formations of the Antilles and Central America. They are (1) the mangroves, or tidal woodlands, and (2) the woodlands above high-tide mark.

These types are formations of the tropical seashore and vicinity and are

characterized by the fact that the fruits or seeds of the composite species have, as a rule, devices which enable them to float. Mangroves and coconut groves are found in greatest abundance within this belt, which is confined to narrow strips along the seacoasts of the eastern and southern part of the republic, broken here and there by protruding headlands of higher elevations and by other areas unadapted to the support of such growth. The mangroves are found in the delta regions of the Rivers Yaque del Norte, Yuna, and Yaque del Sur.

Conclusion

Such are the forestal resources of the Dominican Republic. Commercially the bulk of the forests is unexploitable at present because of the unfamiliarity of the world markets with the exact nature of the woods, but as they become better known the real value of these forests will be more appreciated. Although the republic is greatly behind the times in its industrial and commercial development, it has a decided advantage over the neighboring islands in having maintained its forests in almost a natural state. But, if this wealth is to remain a permanent asset, measures must be taken to control the destruction that has already begun. The commonly known system of "conuco making," which is directly responsible for destruction of the forest, has placed Porto Rico in an undesirable economic position in respect of timber resources; and, should it continue in the Dominican Republic, that country will suffer the same fate—many devastated areas and a scarcity of wood for even the most humble of domestic uses. Any forester will grant that agriculture is a higher use of the soil and that it is of more fundamental importance to the development of a nation than the preservation of the forest trees; but to sacrifice one for the temporary progress of the other is more detrimental than beneficial. In the vicinity of Maniel (San José de Ocoa) particularly, acres and acres of cleared land that have served a temporary progress of providing a few scanty crudely cultivated agricultural crops, and that have long since been abandoned, are but a few examples of what is taking place over the entire forested area of the Dominican Republic. Such clearings are on a small scale, to be sure; but with increasing population will come increasing destruction, for the people as a whole are purely agricultural. An attempt has already been made to correct the destructive tendency and to further the utilization of the forests. A continuance of this policy is necessary if the republic is to maintain its present enviable position as regards timber resources.

Appendix

The following list contains some of the tree species previously referred to in this article. Specimens of these woods were collected under the name used locally in the Dominican Republic and were brought to the United States for study and deposited with the collection of tropical woods at the School of Forestry, Yale University. In most cases it has been possible to establish the scientific identity of the species, and in such instances the technical name is listed with the common name. No detailed study, however, has as yet been

made of these specimens, and hence only the better-known of the species have been identified. There is a possibility that the local classification differs in different parts of the republic. By a preliminary examination of the specimens and by comparing them with other known woods of tropical and semitropical countries, together with the application of such knowledge concerning similar woods as is available, the following scientific nomenclature has been determined. In some cases identity was not established beyond the family name.

No attempt has been made to correlate the species with the vegetative types established, because of insufficient information concerning their distribution. In general, however, the majority of these tree species occur in the partly evergreen hardwood type at elevations between sea level and 1,000 feet.

Baitoa, caoba, cedro, espinillo, mora, guayacán, campeche, and sabina are the more important woods of commerce. Baitoa is used in connection with the manufacture of scientific apparatus as a boxwood; caoba is the true mahogany of commerce; cedro is considered an excellent wood for cigar boxes and other containers of tobacco products; espinillo is known on the market as satinwood; mora is commercial fustic which is a source of vegetable dye; guayacán is lignum-vitae, especially desirable for use as brush bearings in ship propellers; campeche is the logwood of commerce, a source of vegetable dye frequently known as haematoxylon stain, and sabina is eagerly sought for as a desirable wood for the manufacture of high grade pencils.

All of these woods are exported from the republic in varying quantities. For the most part they are more valuable as products for export than for local consumption.

Bayahonda, candelón, capa prieto, capa de sabana, and calla blanca are woods which are almost entirely used locally, chiefly for railroad ties, native sugar-mill rollers, ox-cart hubs, and wheel spokes. Hoja ancha is purchased by the government in natural tree lengths for telephone poles. Pichipin is made into saw lumber, but to a very limited extent, and is all readily consumed in the immediate vicinity of the small mills. Almácigo is said to make very desirable wood pulp for high grade paper manufacture.

Aguasero
Alfiler (*Betulaceae*)
Almácigo (*Bursera gummifera*)
Amacei, copaiba (*Copaifera officinalis*)
Ausubo (*Myrtaceae*)
Baitoa (*Phyllostylon brasiliensis*)
Bayahonda (*Calliandra formosa*)
Cabilma (*Cedrela angustifolia*)
Calla blanca
Calla colorada (*Sapotaceae*)
Campeche, logwood (*Haematoxylon campechianum*)
Candelón (*Colubrina ferruginosa*)
Caoba (*Swietenia mahogani*)
Capa de sabana (*Petitia domingensis*)
Capa prieto (*Cordia gerascanthus*)
Cedro (*Cedrela* sp.)
Ceiba, silk-cotton tree (*Ceiba pentandra*)
Chicharrón (*Chicharronia intermedia*)
Cigua (*Lauraceae*)
Coquito (?)
Corbana (?)
Daguilla, or la guilla (?)
Escobón (*Myrtaceae*)
Espinillo, satinwood (*Zanthoxylum* sp.)
Espino ruvial (*Rutaceae*)
Granadillo (*Gymnanthes lucida*)
Guaconejo (*Amyris silvatica*)
Guasumilla (?)
Guayacán, lignum-vitae (*Guaiacum officinale*)
Higuerillo (?)
Hoja ancha (*Myrtaceae*)
Laurel (*Lauraceae*)
Malagueta (*Sapotaceae*)
Mangle blanco (*Laguncularia racemosa*)
María, or Santa María (*Calophyllum calaba*)
Membriyo (*Cerasus occidentalis*)
Mora, fustic (*Chlorophora tinctoria*)
Nisperillo (*Sapotaceae*)
Olivo (?)
Ozua (*Myrtaceae*)
Pichipin (*Pinus occidentalis*)
Quebra hacho (*Dipholis nigra*)
Roble blanco (*Tecoma pentaphylla*)
Roble prieto (*Catalpa* sp.)
Sabina (*Juniperus* sp.)
Saona (?)
Sapotillo (*Sapotaceae*)
Sinaso (?)
Yaya (*Cordia* sp.)

In the following list are other tree species that the author has seen growing in the Dominican Republic. Those tree species which have the same local, or common, name as is contained in a list of Dominican trees by D. José Ramon Abad have been correlated with the common names of the tree species as they are known to the author, and the scientific identity as established in the former case is included herewith. The better known of these little-known woods are mangle rojo (or colorado), divi-divi, lana, and ébano. Mangle rojo supplies a tanbark. Considerable quantities of this bark are shipped annually, principally from the port of Sánchez. Divi-divi produces a bean which furnishes a valuable dye. This product has, however, in recent years become practically exhausted. Lana produces a vegetable wool which at certain seasons of the year is collected by the natives, baled, and exported. Ébano is the ebony of commerce and is exported in limited amounts. Javillo, known in some foreign markets as possumwood, is found in varying quantities, but as yet none has been exported.

Some of the listed tree species produce edible fruits at certain seasons of the year. Of these algaroba, almendrón, guanabano, and caimitillo are the most important.

Acana (*Acrasia* sp.)
Aceituno (*Aextoxicon punctatum*)
Algaroba, W. I. locust (*Hymenaea courbaril*)
Almendrillo (*Pommus occidentalis*)
Almendrón (*Terminalia catappa*)
Bera, or vera (*Bulnesia arborea*)
Cabo de hacha (*Trichilia spondiodes*)
Caimitillo (*Chrysophyllum oliviforme*)
Cañafístulo (*Cassia fistula*)
Caobilla de costa (*Croton lucidus*)
Caucho (*Castilla elastica*)
Chácara (*Coulteria fistula*)
Cochinilla (*Comocladia integrifolia*)
Cocuyo (?)
Copey (*Clusia rosea* and *alba*)
Divi-divi, or guatapana (*Caesalpinia coriaria*)
Ébano de Santo Domingo (*Brya ebenus*)
Espino (*Zanthoxylum lanceolatum*)
Guanabano (*Artabotrys palustris*)
Guara (*Cupania americana*)
Guaraguao (*Bucida capitata*)
Guaraguao, or cacao (?)
Guayacancillo (*Guaiacum verticale*)
Higo (*Ficus* sp.)
Higuera (*Crescentia cujete*)
Jagua (*Genipa americana*)
Jagüey (*Ficus* sp.)
Javillo, possumwood (*Hura crepitans*)
Jia (*Casearia alba*)
Jobos, hog plum (*Spondias* sp.)
Juan prieto (?)
Juan primero (?)
Lana (*Bombax pyramidale*)
Limoncillo cimarrón (*Pimenta pimento*)
Mangle rojo, or colorado (*Rhizophora mangle*)
Nogal (*Juglans jamaicensis*)
Palo amargo (*Ceanothus americanus*)
Palo blanco (*Tecoma leucoxylon*)
Palo de leche (*Brosimum galactodendron*)
Palo de tabaco (?)
Palo muñeco (*Quassia amara*)
Péndola (*Catalpa* sp.)
Tarana (?)
Vara de lazo (?)
Yagua (*Varronia alba*)

GEOGRAPHICAL RELATIONS IN THE DEVELOPMENT OF CUBAN AGRICULTURE

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Cuba, the last of the independent nations that have sprung from the wreck of Spain's colonial empire in the New World, began its separate national existence in 1899. Its rapid progress and material prosperity cause it to stand out among the Latin American states. In 1920 the island, whose area is only about that of the state of Pennsylvania, had a part in international trade greater than that of Brazil and nearly three times as large as that of Spain. The high ranking of Cuba in this year, due in large measure to the high price of sugar at the time, is an indication of the vast importance of Cuba's principal product. In the fiscal year of 1920 the island sold to the outside world products valued at $850,000,000, and 91 per cent of this was sugar. For the calendar year of 1920 the exports amounted to $573,000,000. The falling off was almost wholly due to the decline in the price of sugar.

Cuba holds first place among the cane-growing countries of the world, though it has risen to this commanding position only recently. Cuban sugar production did not reach a million tons a year until 1895, shortly before the end of Spanish rule. Since Cuba attained independence and its relations to the United States became closer, sugar production has nearly quadrupled. There is no other independent country so completely devoted to a single industry as Cuba is to sugar. The life of the island centers around this product. Everywhere men talk sugar; it dominates politics and finance, and its price determines activity in every line of business. The sudden drop in price in 1920 was a stunning blow to Cuba, and the whole financial system of the nation staggered under it. The abounding prosperity which had nearly amounted to intoxication suddenly came to an end, and the ensuing financial strain brought the island to the verge of collapse.

This dominance of sugar is peculiarly the outgrowth of the island's geographical position, coupled with its endowment of fertile soil and level land. These features will be considered in relation to the development of this and other subordinate resources of the island.

THE HIGH PROPORTION OF AGRICULTURAL LAND

While Cuba is a part of the Antillean mountain system, it has been largely reduced to fertile plains.[1] Only in the eastern quarter is the island dis-

[1] For a condensed account of the geology see M. L. Fuller: Notes on the Hydrology of Cuba, *U. S. Geol. Survey Water-Supply Paper 110*, pp. 183–199. For a more complete account see "Report on a Geological Reconnoissance of Cuba" made to General Leonard Wood by Hayes, Vaughan, and Spencer, and published in 1901.

FIG. 1—Map of Cuba showing relief. Scale approximately 1: 6,600,000.

tinctly mountainous, and the total mountainous area does not exceed one-fifth.[2] The Sierra Maestra range, close to the southern shore of Oriente, rises to elevations of nearly 9,000 feet. This is the most wild and undeveloped part of Cuba, yet a great deal of the province is made up of fertile valleys and gentle slopes. One valley, that of the Cauto, 100 miles long, is the most pronounced valley in the island and is very fertile. In recent years the largest increase in sugar plantations and sugar mills in any part of Cuba has been in Oriente.

A low range of mountains—the Sierra de los Organos—attaining heights of 2,500 feet, extends parallel to the northern coast in Pinar del Rio, the westernmost province. However, the nearly level plains of this province exceed the area of the mountains and include the most valuable tobacco land of Cuba, the Vuelta Abajo district west of Havana. A few other groups of low mountains and occasional spurs exist near the southern coast and near the northern coast, but they are neither long nor high. Of these the most picturesque are the Trinidad Mountains near the southern coast in the province of Santa Clara. One extensive swampy area, the peninsula of Zapata, occupies a strip 60 miles in length and 25 in width on the southern coastal plain west of Cienfuegos. The rest of Cuba, and the major part, is made up of level or nearly level lands sloping gently from an almost indiscernible water-parting extending lengthwise of the island. Contrary to the showing on many maps, no mountain chain extends east and west through the middle of Cuba; the trunk railroad of the island traverses this middle line. Over 80 per cent of Cuba is actual or potential agricultural land, and 10 per cent more is equal in quality to land that produces crops in Java, China, and Japan. Cuba could, if necessary, grow more sugar cane than all the world now produces.

The Great Fertility of the Soil

The ancient land of Cuba was submerged beneath the sea for geological periods of great length and was buried beneath a thousand feet or more of sediments, the greater part of which is limestone. Two-thirds of the island is still covered by this limestone, deeply disintegrated. In places the younger rocks have been entirely denuded, and the masses of ancient crystallines project through the sedimentary beds like islands rising above the sea.[3] The limestones are honeycombed with caves, some of them—as, for instance, the caves of Bellamar in Matanzas—are famous for their extent and beauty. Many streams disappear into the ground and perhaps reappear; while over large areas there is no surface drainage whatever. The

More recent data are contained in "Contributions to the Geology and Paleontology of the Canal Zone, Panama, and Geologically Related Areas in Central America and the West Indies," *U. S. Natl. Museum Bull. 103*, Smithsonian Instn., Washington, D. C., 1919. An account of the physiography and stratigraphy of Cuba and the Isle of Pines by Dr. Vaughan of the U. S. Geol. Survey is promised for forthcoming publication.

[2] R. T. Hill (Cuba and Porto Rico with other Islands of the West Indies, New York, 1898) estimates the mountainous area at one-fourth.

[3] J. W. Spencer: Geographical Evolution of Cuba, *Bull. Geol. Soc. of Amer.*, Vol. 7, 1896, pp. 67–94.

residual loams, both red and black, are derived from the age-long disintegration of the limestones and have the characteristic fertility of such soils. Though parts of Cuba have been cropped for four hundred years, very little of the sugar land is artificially fertilized. The cane yield per acre is larger than in almost any other region of America and larger than in Java or India but only half as large as in the irrigated lands of Hawaii.

The Many-Harbored Coast

Cuba rests upon a submarine platform which is much larger than the island itself. Over this platform the waters are shallow, and coral growth is abundant. A barrier of coral islands or reefs—said to be 570 in number—parallels a part of the northern coast, and an even larger number (730) are scattered along the southern shore.[4] Nearly everywhere the coast is abrupt and clifflike. Along much of the northern coast and along the southern coast of the province of Oriente, rock terraces, rising one above the other, are conspicuous features. At least six of these are recognizable near Matanzas east of Havana,[5] and eight occur near Santiago, the highest being 400 feet above the sea.[6] These terraces plainly represent successive uplifts of the land, the uplift being greatest at the eastern end of the island. Further evidence of these uplifts is seen in the young valleys and gorges carved in the floors of the older valleys. These are especially noticeable from the railroad as one rides through the province of Oriente.

A low divide occupies the main, or east-west, axis of the island, and numerous short rivers flow either to the north or to the south except in the mountainous province of Oriente. At the mouths of the rivers landlocked harbors occur, numerous and excellent. As Hill says, "They are so conveniently situated as regards different portions of the island that the trade of Cuba may be said literally to pass out at a hundred gates."[7] Almost every one of the harbors has a characteristic pouch shape—a narrow entrance opening into a broad bay (Fig. 2). The uniformity in the shape of these harbors on both sides of the island suggests that they are due to a common cause. Havana, Cienfuegos, and Santiago—the most important harbors of Cuba—are all similar. The harbor of Nuevitas (Fig. 2) on the northern coast is a good example of these peculiar pouch-shaped bays of Cuba. The entrance to this harbor is only one-sixth of a mile wide in the narrowest portion and broadens as you proceed from the sea to the inner bay, which is eight miles broad. At the narrowest place in the entrance the water is over 100 feet deep but is much shallower in the broad part of the inner bay. Clearly this deep narrow channel connecting the ocean with the broad inner bay is a young valley cut by a stream through the

[4] R. T. Hill, *op. cit.* p. 36.

[5] J. W. Spencer, *op. cit.*

[6] T. W. Vaughan and A. C. Spencer: The Geography of Cuba, *Bull. Amer. Geogr. Soc.*, Vol. 34, 1902, pp. 105-116; reference on p. 113.

[7] R. T. Hill, *op. cit.*, p. 86.

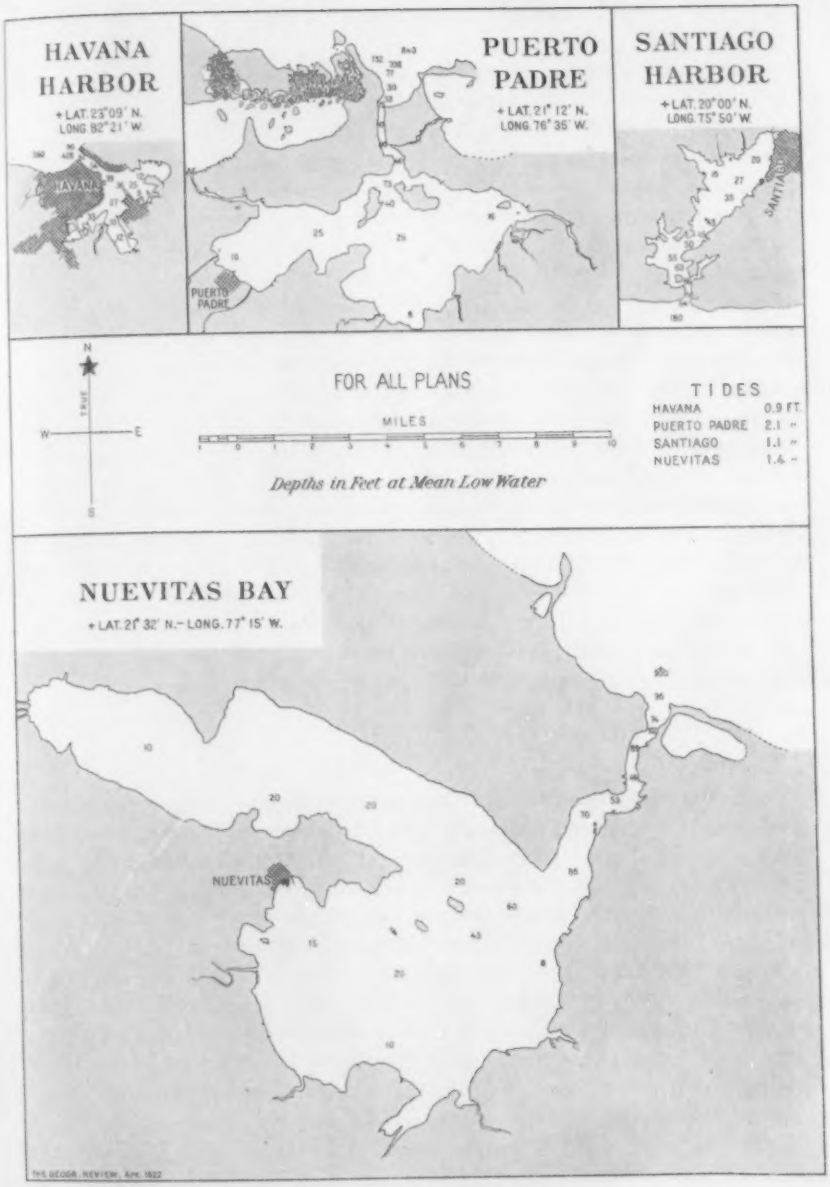

FIG. 2—Examples of the characteristically pouch-shaped harbors of Cuba. The four maps are drawn to the same scale and are based on U. S. Hydrographic Charts, Harbor of Habana (No. 307), Port Padre (No. 1970), Santiago Harbor (No. 1856), Nuevitas Bay (No. 1883).

younger rock formation along the shore; tidal currents may have aided. The youngest part of the entrance channel is the part nearest the ocean, and this fact suggests strongly that the successive uplifts of the coast lands have been gradual enough to permit the river and the tidal currents to maintain a channel across the rising coast strip of coral reef or other rock. The steplike terraces which are so common along the Cuban coast prove the successive uplifts, and the shape of the harbor entrances—narrowest at the seaward end—indicates that the most youthful parts of these channels are at the outer or seaward ends. The notable depth of many of the harbor entrances seems to indicate a recent moderate sinking of the coast. That the pouch-shaped harbors are drowned drainage basins is the theory held by Hayes and Vaughan, who find a particular demonstration of the validity of the theory in present conditions along the Yumuri River near Matanzas. "The river here empties into the sea through a narrow gorge cut through Miocene limestone and marls . . . Above the gorge, the Yumuri and its tributary, Rio Caico, have sunk their courses through the limestone, have removed it, and have developed wide, almost base-level valleys on the underlying softer sandstone and shale. If this basin were depressed sufficiently to let the sea into it through Yumuri gorge a pouch-shaped harbor would result."[8] The number of such harbors on both coasts and their excellence greatly facilitate the exportation of the enormous sugar crop, preventing the congestion which must occur if only a few ports were used.

The Cuban Climate[9]

The outstanding features of the temperature of Cuba are the uniformity throughout the year and from year to year. The three warmest months at Havana average only 10° warmer than the three coolest, while the difference at Santiago de Cuba is only 5° or 6°. Contrast this with the temperatures at Galveston which vary from 83.3° in summer to 55.6° in winter, or 27.7°. The highest recorded temperature in Havana is 100.6° in July, 1891; and the coldest is 49.6° in February, 1896. The temperature in any given month varies little from year to year. The difference in mean temperature between the warmest and coolest recorded July is less than 2°, and between the coolest and the mildest January is less than 6°. Snow is unknown, and frost is known only in the higher altitudes. There is also a marked uniformity of temperature throughout the island (disregarding the influence of altitude in the mountainous sections). This is largely due to the equalizing effect of the surrounding ocean and to the fact that the long axis of the island extends east and west rather than north and south.

[8] T. W. Vaughan: Fossil Corals from Central America, Cuba, and Porto Rico, etc., *U. S. Natl. Museum Bull. 103*, pp. 189–524; reference on p. 284. A fuller discussion of the Cuban harbors is promised in a forthcoming paper.

[9] The data used in the section on climate are taken for the most part either from official publications of the U. S. Weather Bureau or from "El Clima de Cuba" by Mariano Gutiérrez-Lanza, *Proc. 2nd Pan Amer. Sci. Congr., Dec. 27, 1915, to Jan. 8, 1916*, Vol. 2, Section 2, Astronomy, etc., Washington, D. C., pp. 132–172.

The rainfall cannot be called heavy, and there is wide variation between years of maximum and of minimum precipitation. On the northern coast the average annual rainfall is 50 inches; on the southern coast, 45 inches; and in the interior, 60 inches. Distribution has a distinctly seasonal character—a "dry" season of about five months (December to April) and

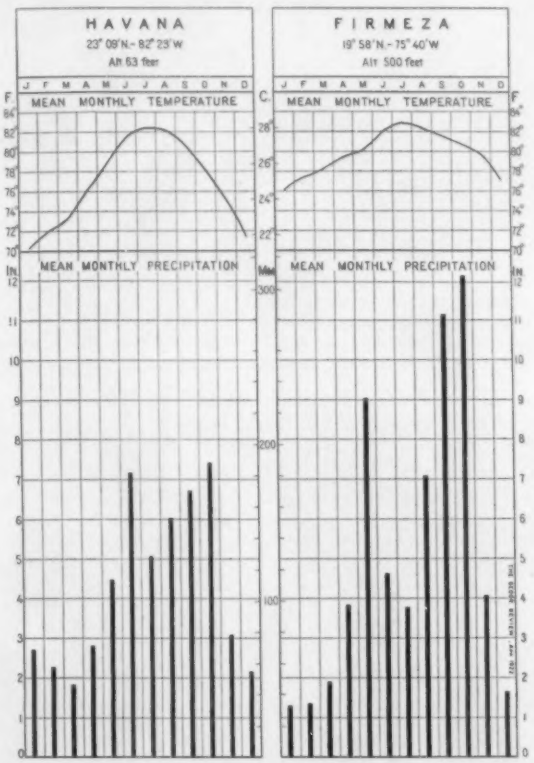
HAVANA
23° 09' N.- 82° 23' W
Alt 63 feet
J F M A M J J A S O N D
MEAN MONTHLY TEMPERATURE
MEAN MONTHLY PRECIPITATION
FIRMEZA
19° 58' N.- 75° 40' W
Alt 500 feet
J F M A M J J A S O N D
MEAN MONTHLY TEMPERATURE
MEAN MONTHLY PRECIPITATION

FIG. 3—Graph showing the mean monthly temperature and rainfall at Havana and Firmeza (near Santiago). The higher land of the eastern end of the island has in general the heavier rainfall. Data from the Annual Report of the Chief of the U. S. Weather Bureau, 1897–1898.

a "wet" season of about seven months (May to November). Over a period of 30 years the precipitation during the wet months ranged from 22 inches to 49.5 inches in Havana, and from 8.8 to 33 inches during the dry months. The heaviest rainfall comes in September and October, months of low atmospheric pressure and hurricanes in the Caribbean region. The heavy rainfall of May is plainly due to a secondary low pressure period occurring at that time.

Rains are of the tropical downpour type; 6 inches of rain have fallen at Havana in 24 hours, and 13 inches at Firmeza near Santiago on the

southern coast. Showers are three times as frequent in the afternoon as in the forenoon; they are soon over, and sunshine returns quickly. Relative humidity is remarkably uniform from season to season, averaging about 75 per cent in Havana through the year in the dry season and wet season alike.

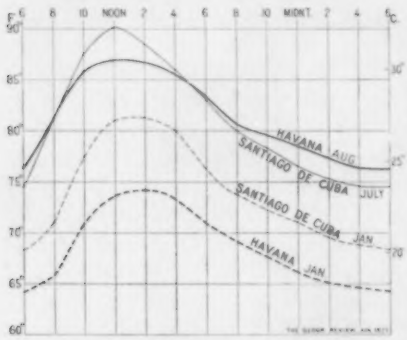

FIG. 4—Graph showing the daily march of temperature in the warmest and coolest months of the year at Havana and Firmera. Data from the Annual Report of the Chief of the U. S. Weather Bureau. 1897–1898.

Cuba is in the belt of trades throughout the year and there is relatively little difference in the strength or direction of the winds from month to month. Tropical hurricanes are occasional but not frequent; of 22 such storms occurring in the West Indies and studied by the U. S. Weather Bureau, only 7 crossed Cuba. The diurnal variation in velocity is pronounced however. Thus at Havana the wind, which has an average velocity of 4.3 miles an hour at 4 A. M., increases to a maximum of 11.4 miles an hour at 2 P. M., diminishing to 5.6 at 10 P. M.[10]

TABLE I—NUMBER OF DAYS PER MONTH ON WHICH RAIN FELL AT HAVANA
(Data for 35 years)

	JAN.	FEB.	MAR.	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
Minimum	1	1	1	0	3	4	7	9	7	7	5	3
Mean	8	6	6	5	9	13	13	13	15	15	10	8
Maximum	14	13	10	9	16	21	20	21	25	22	16	16

Such are the more salient features of the Cuban climate. As regards relation to the most important crops of the island note should be made of the following points: (1) Freedom from frost—permitting sugar cane to grow year after year without replanting; (2) a hot, rainy season ideal for the growth of cane; (3) a season of light rainfall, suited to the harvesting of sugar cane, which is injured by wetting after it is cut, unless promptly ground; (4) freedom from extremes of temperature; (5) a climate suited to white occupation and much relieved by cool nights and by the trade winds which, strengthening in the afternoon coincidently with increasing temperature, afford a delightful unfailing breeze that takes away much of the oppressiveness of the tropical heat. On the whole, Cuba has a climate that is ideal for vegetation and not ill suited to the maintenance of an energetic race.

[10] *U. S. Weather Bur., Rept. of the Chief, 1897–98*, p. 314.

The Forests

Originally Cuba was largely but not entirely forest-covered. In 1899, when the first careful census was taken, it was estimated that 27 per cent of the area was covered with large timber and 14 per cent with small timber; a part of the latter was presumably new growth on lands formerly under cultivation. Thus, in 1899, 41 per cent of the island was forested, and the major part of this was in the eastern end of the island. Clearing is still in progress, for the newly cleared ground affords the most productive cane land. The census of 1907 gives the following distribution of forests by provinces: Oriente 520,000 acres, Santa Clara 308,000 acres, Pinar del Rio 148,000 acres, Matanzas 113,000 acres, Camaguey 88,000 acres, Havana 49,000 acres. Evidently these figures include only forests containing merchantable timber, for the total, 1,220,000, is less than five per cent of the land area of the island, and certainly four or five times this area is covered with forest growth of some sort. Occasional glowing accounts of the great wealth of mahogany and cedar in Cuba are only partially true.

Agriculture

In early colonial days cattle raising was the chief occupation of the colonists, and it has remained an industry of importance down to the present time. The latest enumeration indicates that there are nearly 4,000,000 cattle in the island, a considerable proportion of which are oxen used as draught animals. A large proportion of the cattle ranges are in the province of Camaguey. Every sugar plantation has many oxen, in some cases reaching into the thousands; they do nearly all of the work of plowing, harrowing, and hauling. They feed upon the stripped-off leaves of the cane and are sleek and fat in the harvest season. The beef animals are slaughtered on the plantations to supply meat for the laborers or are sent to the cities for supplying the meat markets. Practically no animals or meat are exported, but certain beef and pork products are imported in large quantities.

General farming as we know it in the United States is not practiced in Cuba. Sweet potatoes, Indian corn, and the yucca are raised to supply a part of the food. Cuba could produce a great deal more of its food than it now produces; but Cubans do not take to this occupation, very few of the country people even having gardens.

The most accurate census of Cuba was that of 1899, at which time the percentage of total cultivated area devoted to sugar cane was 47.3, to sweet potatoes 11.3, to tobacco 9.3, to bananas 8.6, to Indian corn 7.3, to malangas 3.4, to yucca 3.2, and to coffee 1.6 (eight other minor crops are listed in the census).

When Cuba became independent, the percentage of land in farms and under cultivation was as shown in Table II.

TABLE II—PERCENTAGE OF LAND IN FARMS AND UNDER CULTIVATION IN CUBA IN 1899

PROVINCE	PERCENTAGE IN FARMS	PERCENTAGE CULTIVATED
Havana	45.6	5.8
Matanzas	41.4	6.6
Pinar del Rio	33.8	4.3
Camaguey	29.2	.4
Santa Clara	30.6	4.0
Oriente	22.0	2.4
Cuba	29.9	3.0

It is reported that at the end of the Spanish régime Cuba had 91,000 plantations, farms, orchards, and cattle ranches valued at $200,000,000—an average of about $2,200 each. Table III shows the reported use of the land in 1850.

TABLE III—POPULATION AND CULTIVATION ACCORDING TO THE CENSUS OF 1850 BY DEPARTMENTS*

		WESTERN	CENTRAL	EASTERN
POPULATION	Total	734,300	246,000	226,930
	White	325,500	153,000	87,060
	Free colored	88,300	42,500	74,770
	Slaves	320,500	50,500	65,100
CULTIVATION	Sugar estates	735	404	303
	Coffee estates	1,012	76	580
	Tobacco estates	3,990	967	4,145
	Grazing estates	1,741	4,881	3,308

* The western department includes Pinar del Rio, Havana, Matanzas; the central, Santa Clara and Camaguey; the eastern, Oriente.

Notwithstanding the great quantity of sugar and tobacco produced in Cuba, not over one-tenth of the area is under cultivation, and several million acres of excellent sugar land have not yet been cleared. Little fertilizing is done.

SUGAR[11]

Cuba's geographical position on the outer margin of the tropics gives it the ideal temperature and rainfall for growing sugar cane. While planters in Louisiana, with its winter frosts, must replant their cane each year, in Cuba cane does not require replanting for eight or ten, or even twelve years.

[11] Much of the statistical matter used in this section is taken from *Bulletin 53, Miscellaneous Series, U. S. Dept. of Commerce*, 1917.

It has already been pointed out that the major part of the soils of Cuba is derived from the breaking down of limestones and that there is a large proportion of level land; according to a recent *Commerce Report* "over three-quarters of Cuba is level enough to admit of the use of the most improved farm machinery." The red lands which are so conspicuous in Havana and Matanzas provinces and which appear elsewhere are a very porous residual clay loam through which water passes readily into the cavernous limestone below, giving excellent drainage and permitting tillage shortly after a rain. These red soils are by many regarded as the best sugar lands of Cuba. The black soils rest sometimes upon a white calcareous subsoil, and sometimes upon an impervious clay subsoil; they are exceedingly fertile, especially when newly cleared, and if drainage is good produce the heaviest crops of cane.

The ground is plowed, cross plowed, harrowed, trenched, and planted with pieces of cane containing one or more joints. During early growth the cane must be cultivated like corn. In from fifteen to eighteen months it is ready for cutting and may be cut annually for many years without replanting. An acre of good land annually yields twenty tons of sugar cane and two tons of sugar. As the cane matures, the lower leaves become dry and easily catch fire; in fact the greatest danger to the cane fields arises from fire, and special precautions must be taken against it.

The large crop of 1920–1921, reaching nearly 4,000,000 tons, was grown on about one-twentieth of the area of the island (1,400,000 acres). Thus five per cent of the land of one island yielded nearly a quarter of the sugar which the world used in 1921. This sugar was ground in about 200 mills.

In 1920–1921 the percentage by provinces of the total sugar crop produced was as follows: Santa Clara, 24; Oriente, 23; Camaguey, 20; Matanzas, 18; Havana, 11; Pinar del Rio, 2.

Each large sugar estate has its own mill, or central, from which railways or tramways radiate. At least one plantation has upwards of 200 miles of railroad and 25 locomotives, while another has 2,800 oxen, mules, and horses; and one group of 22 plantations has 15,000 work animals. The investment in a plantation and its mill reaches into the millions. A few of the largest mills produce 700,000 to 800,000 bags, or 200,000,000 pounds, of sugar a season. The cutting season is from December to about June, but it may extend even to September. The owner of the central produces only a minor part of the cane needed by his mill; the greater part—said to be 80 per cent—is grown under contract by tenant planters, called *colonos*, or is purchased from independent growers. There are about 22,000 *colonos* thus engaged in Cuba, the average area cultivated by each being about 66 acres. The cane is cut and stripped by hand, and this calls for a large force of laborers during the cutting season; but there is not sufficient employment for these laborers during the remainder of the year. Large numbers of Jamaicans and other West Indian negroes come for the sugar harvest, and many return home in the dull season. Some labor is recruited from

FIG. 5—Map of Cuba showing railroads, sugar-exporting ports and sugar centrals in 1920. The inset graph shows the amount of sugar export by ports. Scale approximately 1 : 6,600,000.

Spain and the Madeira Islands, but there is never enough. Shortage of labor is the chief problem that has to be faced by the planters. A majority of the 80,000 yearly immigrants into Cuba come for the sugar harvest. Much of the work is done as "piece work," the laborer being paid by the ton or by some other unit.

If Cuba could get labor or invent machinery to harvest the crop, the island could supply more sugar than all the world now produces. At average prices one good crop of cane is worth nearly the price of the land, and it is said that practically every central in Cuba made enough to pay for itself in 1918 and 1919; but in 1920–1921 little if any profit was made, and some of the largest companies lost heavily.

The cane is hauled to the railways and sometimes to the mills in ponderous ox carts over very bad roads, and the cost of getting the cane to the mill is one of the large items of expense. All parts of the island are so near the coast and there are so many harbors that no plantation is far from a shipping port. The increased production of recent years is mainly due to the many new American-owned estates which are being brought under cultivation in the eastern provinces of Camaguey and Oriente.

Cuba's geographical position is most advantageous for marketing the sugar, for it lies at the door of the greatest sugar-using nation in the world. The ocean freight rate on raw sugar from Cuban ports to New York, Boston, or Philadelphia, together with commission, brokerage, etc., normally is around a quarter of a cent a pound, an almost negligible figure. Moreover, the nearness of Cuba and its close relations with the United States have made it easy to attract American money, which has revolutionized the sugar industry by erecting the largest and most efficient of mills and by supplying ample funds for financing the industry. In 1916 the average cost of producing raw sugar in Cuba, including depreciation of plant, was less than 1.5 cent a pound, and a few mills made it at a cost of 1.1 cent a pound. With Spanish methods it cost three or four times as much, and present costs are twice as high as they were in 1916. About 40 per cent of the mills in 1916 were classed as American-owned, and at least $600,000,000 of American capital was invested. The number of American-owned mills has doubled since 1914, and they now grind more than half of the sugar. One company, the Cuba Cane Sugar Corporation, has over 20 estates, involving an investment of more than $50,000,000. An editorial note in *Facts About Sugar* of July 10, 1920, says: "The number of mills and plantations that have changed hands during the past six months represent values that run into the hundreds of millions of dollars. They exceed similar transactions of the past decade." In 1915 the sugar companies owned over 3,000,000 acres of land, less than half of which was under cultivation. Since that date many large purchases of land have been made, and it is probable that the holdings of the sugar companies now equal or exceed 4,000,000 acres.

Nearly all of the sugar is shipped from twenty ports, the majority of

which are on the northern shore of the island. The proportion shipped from any given port fluctuates from year to year but not very greatly.

The Tobacco Industry

It was in Cuba in 1492 that Europeans first came in contact with tobacco, and it is in Cuba that the finest tobacco is still grown. The trade recognizes four general types of Cuban tobacco. The coarse, cheap grade grown in the province of Oriente is known as *Mayari y Gibara*. The *Remidios* of Santa Clara province and the *Portidos* of Havana are better in quality, but the tobacco that has made Cuba famous is the *Vuelta Abajo* of the province of Pinar del Rio in the western end of the island. Here in a very definitely marked area about 90 miles long and 10 miles wide, lying just south of the Organ Mountains, is grown the world's finest tobacco. It has been proved that the flavor and aroma of tobacco are determined more by soil than by climate. The texture and other physical qualities of the leaf are greatly improved by growing the plants under a covering of cheesecloth. The soil of the Vuelta Abajo district is a peculiar sandy loam, quite in contrast with the clay loams of the sugar-growing districts.[12] Why this particular soil should impart to the leaf the delicate and delightful quality possessed by no other tobacco in the world is an unexplainable but unchallenged fact.

The tobacco farms, called *vegas*, average from 30 to 40 acres in extent and are usually operated by Cuban owners with white labor—quite commonly Canary Islanders. Tobacco is a winter crop; the plants are set late in October in soil heavily fertilized and prepared with utmost care. In the Vuelta Abajo district one man devotes his whole time to about 2 acres, cultivating, pruning, and keeping off insect pests. This means that about 20 men are employed on the average farm of 40 acres. It has been estimated that 80,000 persons are employed in tobacco culture in Cuba.[13] Somewhat more than half of the tobacco grown in Cuba (in value) comes from the Vuelta Abajo district. Good tobacco land in this district is worth a thousand dollars an acre, or more, and often produces a thousand dollars' worth of tobacco per acre per year and in exceptional cases even two or three times as much. The leaves are cut in January, very carefully cured, and packed in bales of 50 kilos each. Havana is the center of cigar and cigarette making, a large part of which is in the hands of foreign corporations employing Cuban labor. The McKinley tariff placed a heavy tax on imported cigars, but a light tax on leaf tobacco; this caused many Cuban manufacturers to establish factories in Key West and Tampa where they continue to use skilled Cuban labor, both men and women.

During the fifteen years preceding the World War the exports of tobacco and its products averaged 22.6 per cent of the total exports from Cuba;

[12] See the descriptions of the Vuelta Abajo district in J. B. Henderson: The Cruise of the Tomas Barrera, New York, 1916, p. 229 *et al.*

[13] R. P. Porter: Industrial Cuba, New York, 1899, p. 306.

but this percentage is declining, having been only 16 in 1914 and 6½ in 1920, while sugar rose to 91 per cent in 1920.

Other Crops

Coffee, once highly important, especially in the eastern end of the island, has all but disappeared—unable to meet the competition of Brazil. The industry was established by refugees from Santo Domingo, some 30,000 of whom came into eastern Cuba about 1798. Cuba had 2,300 coffee plan-

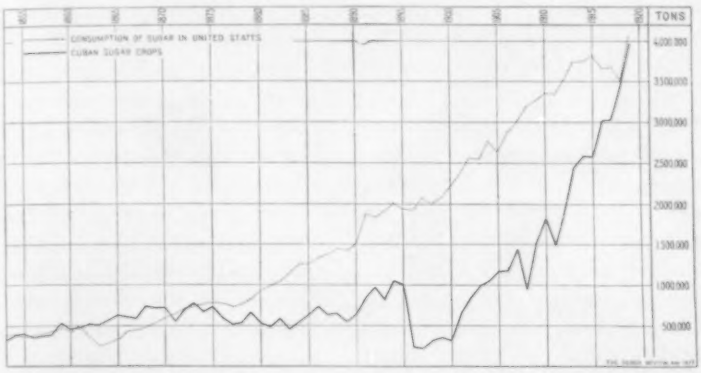

Fig. 6—Graph showing the importance of Cuban sugar production to the United States and the advantage to Cuba of a near-by market for her principal product. Note the effect of the rebellion of 1895 and the Spanish-American War.

tations large and small in 1846, at which time the permanent decline of this industry began in consequence of the violent hurricanes of 1843 and 1846. There was a partial revival after the independence of the island was achieved in 1898, but it was of short duration.

Henequen has been introduced from Yucatan and is doing well on land that was regarded as useless. Most of it is raised in the province of Matanzas and has given rise to two or three large mills.

Systematic fruit growing is relatively unimportant in Cuba, though a good deal of fruit is actually grown—much of it in a more or less haphazard way. The banana and the pineapple plantations attempted by Americans have been only partially successful financially. The fruit lands of the Isle of Pines, south of the western end of Cuba, are largely owned by Americans who have developed pineapple and grapefruit growing with moderate financial success. These fruits go by boat, daily trains, and car ferry to the United States. Over a million crates a year were shipped in the years around 1910, but the industry has since declined. Cuban oranges are delicious, but their production supplies only the home demand. It seems surprising that a tropical island like Cuba should import as much fruit as

it exports, but such is the case. Crawley[14] says that, of all the fruits that have been tried on a commercial scale, only oranges and grapefruit have given remunerative results.

The Cuban Population

From the point of view of agricultural development the population of Cuba is not large. It is less than one-tenth of that of Java which has less agricultural land and still provides a surplus for export. According to the enumeration of 1909 (Statesman's Year-Book, 1921) Cuba has a total population of 2,898,905[15] of whom 1,020,411 dwelt in 11 cities.[16]

The permanent increase in population has averaged 65,000 a year during the twenty years of independence, while the excess of births over deaths averages from 40,000 to 45,000 annually, leaving a balance of some 20,000 a year to be accounted for by immigrants who stay in the country. Since the total immigration into Cuba is around 70,000 annually, it is evident that the great proportion of these do not remain permanently. This is, on the whole, a favorable arrangement for Cuba, although still more labor is needed between December and June of each year. Cuba seriously needs other industries which can absorb the unemployed labor of the dull season.

The Spanish explorers found Cuba inhabited by kindly Indians living peacefully under several independent chiefs. Their number was variously estimated at from 200,000 to 1,000,000. The latter figure is the estimate of Bishop Las Casas, one of the most careful students of Indian matters, yet it seems much too high. Under the enforced labor and cruelty of the Spaniards and the white man's diseases, the Indians rapidly disappeared and became practically extinct by 1550. As early as 1521 the importation of African slaves began and continued down to the middle of the nineteenth century. In all, a million blacks were imported.[17] Slavery was abolished in 1880, but many negroes had purchased or otherwise secured their freedom before that date. Much mixing of blood occurred, and it is probable that many of the people who are classed in the census returns as white have a strain of African blood in their veins. Spain did not draw the color line so closely as England or America, and it is not closely drawn in Cuba today. The census of 1877 gives Cuba 1,521,684 inhabitants and reports less than one-third of them as "colored" and over two-thirds as "white." An effort at close discrimination would be unwise and futile, yet the traveler in Cuba is quite skeptical of the latest census figures which class 75 per cent of the Cubans as white. There are unquestionably many pure-blood

[14] J. T. Crawley: Progress of Agricultural Science in Cuba, *Proc. 2nd Pan Amer. Sci. Congr., Dec. 27, 1915, to Jan. 8, 1916*, Vol. 3, Section 3, Conservation, etc., Washington, D. C., pp. 374–382.

[15] By provinces: Pinar del Rio, 266,198 (51 per sq. m.); Havana, 697,583 (219 per sq. m.); Matanzas, 312,704 (95 per sq. m.); Santa Clara, 657,697 (70 per sq. m.); Camaguey, 735,810 (22 per sq. m.); Oriente, 735,810 (51 per sq. m.).

[16] The cities are: Havana, 360,517; Camaguey, 93,057; Cienfuegos, 83,092; Santiago de Cuba, 63,041; Manzanillo, 62,485; Guantánamo, 60,216; Sancti Spiritus, 58,843; Santa Clara, 57,767; Matanzas, 56,468; Pinar del Rio, 52,472; Cárdenas, 32,513.

[17] Census of Cuba, 1899, p. 68.

white Cubans, most of whom are of Spanish extraction. There are also several hundred thousand blacks; the latter are almost wholly engaged in the heavier forms of unskilled labor, especially the labor on the sugar plantations. Regarding the negro of Cuba, the census of 1899 (p. 69) says: "While the statistics of Cuba show a larger proportion of colored than white criminals, the colored population are in some respects superior to the colored population of our Southern States, being more self-reliant, temperate, frugal, and intelligent and, since the abolition of slavery (1880), showing a strong desire to own their own homes, to educate their children, and to improve their condition. In certain kinds of agriculture they are preferred to any other race. . . ."[18]

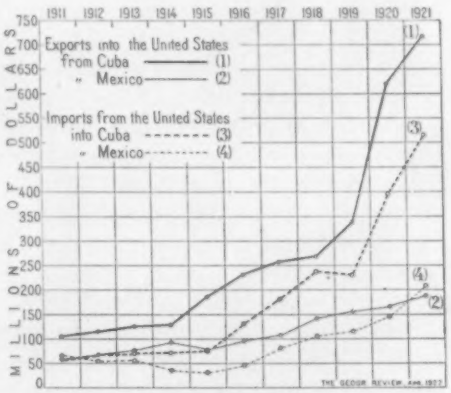

FIG. 7—Graph showing the recent growth of trade between Cuba and the United States. The effect of the close relations between the two countries appears the more striking when comparison is made with trade between Mexico (whose population is 5 times that of Cuba) and the United States.

The country homes of the working people are primitive thatched huts of one or two rooms, usually with an opening for a door and with two or three windows. Often there is no floor and almost no furniture. The weather is never cold, and protection from rain is about all that is needed. One of the most striking contrasts between country life in the United States and in Cuba is in the homes and their surroundings. An attractive country home is seldom seen in Cuba except near the cities or around the sugar centrals. As a rule, little or nothing is done to beautify the surroundings of the homes in the villages and smaller towns. Such work requires effort, and the average Cuban in his tropical climate does not care to expend effort upon such things. Even vegetable gardens are seldom seen, for gardens, too, require effort, while plantain and banana trees do not.

Roads and Railways

Most country roads, if indeed they may be called roads, are wretched, and in the rainy season well-nigh impassable for wheeled vehicles. During the American occupation excellent macadamized roads were built out from a few of the chief cities, and additional ones have been built by the Cuban government, making a total of 1,300 miles of first-class roads. The principal railways are good. Two Pullman trains leave Havana daily for Santiago, and two return, making the one-way trip of 550 miles in about

[18] See also R. T. Hill: Cuba, *Natl. Geogr. Mag.*, Vol. 9, 1898, pp. 193–242; especially pp. 224–233.

24 hours. The three western provinces are well supplied with railways, but Camaguey and Oriente have large areas without any. However, the constant extension of sugar estates in these provinces is resulting in a constant extension of railway lines. The main trunk line through the middle of the island is joined by lines reaching the many ports, and a great number of short lines connect the sugar centrals with the main lines or with the ports. In all, the island has some 2,800 miles of railway, or six miles for each 100 square miles of land area; this is about the same as in California or Colorado. In addition to the regular railway lines, there are some 4,000 miles of plantation railways belonging to the sugar estates and used wholly in their service. These roads have over 600 locomotives and nearly 20,000 cars for conveying cane. Despite this good showing, parts of Cuba suffer from the lack of transportation facilities. The wretched country roads add heavily to the expense of hauling all of the cane that moves over them. During the war, when manganese was in great demand, several of the mines of Cuba could respond but feebly because of the cost of about a dollar a ton-mile for transporting the ore five to ten miles by carts over unimproved roads.

The Great Foreign Trade of Cuba

Aside from sugar and tobacco, the manufacturing industries of Cuba are small. There is, in consequence, a very heavy import trade in manufactured goods, 90 per cent of which comes from the United States. Cuba's population of less than 3,000,000 buys more American goods than China's 400,000,000; and in 1920 Cuba sold us products of greater value than any other country in the world. The benefit to Cuba of stable government and of close business relations with the United States comes out in a comparison of the trade of Mexico and that of Cuba with the United States between 1911 and 1920. As shown in Figure 7, the trade between Mexico and the United States increased but little while that of Cuba increased 600 per cent. The make-up of Cuba's export trade has averaged about as follows: sugar and its products, 75 per cent; tobacco and its products, 16 per cent; fruit, 2 per cent; minerals, 2 per cent; animals and animal products, 2 per cent; forest products, 1.5 per cent; miscellaneous, 1.5 per cent. The per capita value of exports from Cuba in 1920 was larger than that of any other nation in the world, and this is the same Cuba that in 1898 was facing starvation, and whose industries were all but ruined. Twenty-five years ago the climate was as good, the rainfall as copious, the soil as fertile, the geographical position the same as they are now; but Spain was in control. In 1898, because Cuba lay at our door, we intervened in her struggle for independence; we established and we now guarantee a stable government. Life and property were made safe with the result that new capital is willing to build million-dollar mills, extend railways, establish banks, and throw a car ferry from Key West to Havana. Cuba is capitalizing her fertile lands and advantageous geographical position.

GEOGRAPHIC FACTORS IN THE RELATIONS OF THE UNITED STATES AND CUBA

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Statement of the Problem

Nearly a hundred years ago President John Quincy Adams wrote:

> . . . there are laws of political, as well as of physical gravitation; and if an apple, severed by the tempest from its native tree, cannot choose but fall to the ground, Cuba, forcibly disjoined from its own unnatural connexion with Spain, and incapable of self-support, can gravitate only towards the North American Union, which, by the same law of nature, cannot cast her off from its bosom.[1]

It has been contended that this principle has a universal application, and for it has been coined the term:[2] "politico-geographical law of gravity." In its general application it may be stated as follows: islands which lie near the borders of continents tend to become politically subordinate to the most powerful mainland neighbor. Cuba is an island of the utmost strategic and commercial importance, having for its nearest continental neighbor the United States, one of the larger, richer, and more powerful nations in the world. On the other hand, the two areas are widely at variance in history, nationality, language, social institutions, and political experience. While their geography has attracted, their social and political life has repelled. The concurrence of these conflicting forces therefore ought to give some proof of the validity of the "law."

Environmental Factors Underlying the Problem

The location of Cuba and the United States has been of mutual importance. Cuba, lying at important crossroads of Caribbean and Gulf trade routes, commands the only two entrances to the Gulf of Mexico and one of the chief passages to the Caribbean Sea (Fig. 1). Thus it is in a position to bottle up the Gulf ports of the United States and to jeopard that nation's control of interoceanic canal routes. Furthermore, its many large and easily defensible harbors could serve as unexcelled bases for enemy ships engaged in blockading the ports or hampering the commerce of the United States. Conversely, for expeditions calculated to tamper with the political order of Cuba, the United States offers near-by shelter, particularly among the keys of Florida, which are separated from the populous sections of the continent by a waste of swamps. To commerce the proximity of island to continent is of basic import, for the short and cheap carriage

[1] Adams to Nelson, April 28, 1823, *32nd Congr., 1st Sess., House of Repr. Ex. Doc. No. 121*, p. 7.

[2] E. C. Semple: American History and Its Geographic Conditions, Boston and New York, 1903, p. 403. Cf. Friedrich Ratzel: Politische Geographie, Munich and Leipzig, 1897, pp. 386–391.

between Cuban ports and those of the southern and eastern coasts of North America has helped to make the United States Cuba's best customer and one of the countries from which it buys most heavily.

The climatic contrasts between the two domains, in conjunction with their proximity, have had further far-reaching results. Cuba, lying in the path of warm rainy trade winds, produces as its agricultural staples sugar and tobacco, besides cacao and tropical fruits and nuts.[2] These find a ready and constant market in the United States, which in turn can supply Cuba with cereals, meat products, and fabricated goods. Furthermore, the predominance of large-scale agriculture in Cuba opens an outlet near home for capital of American investors who wish to keep an eye on their projects. Finally, the fact that Cuban agriculture is chiefly of the plantation type resulted in the use of negro slaves, and the island was entangled for years in the perplexing slavery issue of the continent. More recently the mild Cuban winters have attracted pleasure seekers from the rigorous climate of northern United States, and Cubans in turn have spent their summers in the northern Appalachians.

FIG. 1—Sketch map to show the situation of Cuba in relation to the United States.

Even the mineral resources of the two areas are reciprocal. Cuba, deficient in mineral fuel, possesses a grade of iron which is necessary to the steel production of the United States; it also possesses copper. These commodities, finding their way to American ports, are replaced on the return voyage by coal and petroleum.

Relations During the Spanish Period

Geographically bound together as the two territories are, it is little wonder that agitation for their political union began very early in the history

[2] See the preceding article, "Geographical Relations in the Development of Cuban Agriculture," by R. H. Whitbeck.

of the United States. In its incipiency this movement was general in statement and procrastinating in operation, but with the increase in the political and commercial power of the young republic and the diminution in the political and commercial significance of Spain, the clamor grew to overwhelming uproar. At first based on geographic hypotheses, the demand for Cuba came by 1840 to be rested on political exigency; after 1865 the cry was changed to commercial necessity and in the years following 1895 to humanitarianism. But these variations in argument meant no desertion of geographic principles, since neither the politics, the commerce, nor the humanitarianism would have appealed in force had Cuba been remote from the shores of the United States.[4] Herein can be traced, nevertheless, the ever widening circles of interest in the island among the people of the mainland.[4]

In the earliest days of the independence of the United States Thomas Pownall, governor of Massachusetts, foresaw the ultimate incorporation of the West Indies into the new North American state: "Whether the West Indies are naturally parts of the North American continent is a question of curious speculation; the whole must in the course of events become parts of the great North American domain."[5]

Definite Expression in Favor of Annexation

Definite pronouncements on Cuba, however, came only after the purchase of Louisiana and the consequent turning of the country's attention to expansion in other directions. It is not surprising that Jefferson, once committed to territorial extension, should put himself on record in favor of annexing Cuba, but it is a remarkable testimony to the state of his geographical outlook that he should have thought it could be defended without a navy. In 1809 he wrote:

> . . . I would immediately erect a column on the southernmost limit of Cuba and inscribe on it *ne plus ultra* as to us in that direction. . . . It will be objected to our receiving Cuba that no limit can be drawn to our future acquisitions. Cuba can be defended by us without a navy, and this develops a principle which ought to limit our views. Nothing should ever be accepted which requires a navy to defend it.[6]

The purchase of Florida by the United States in 1819 once again turned the public mind to further acquisitions in that direction, and after 1820 nearly every administrative leader of three decades is on record in reference to Cuba. The keynote to this period (1820–1848) was the fear of the United States that some strong European power, either France or Britain, would

[4] The following classes of sources are the chief reservoirs of information: geographic theories and political platforms can be traced in the speeches and writings of public men; commercial interests found voice through the same channels, in periodical literature, and in government reports on commerce; humanitarianism was in part the cloak thrown about the subject by those who had interests of a more material sort, and its effects may be followed in public opinion during 1898.

[5] Quoted in A. B. Hart: The Foundations of American Foreign Policy, New York, 1901, p. 108.

[6] Jefferson to Madison, April 27, 1809; quoted in F. E. Chadwick: The Relations of the United States and Spain—Diplomacy, New York, 1909, p. 216.

seize the coveted island before it was ripe to drop into the lap of its neighbor. This corroborates the contention that the attraction of a more remote but stronger country may prove more potent than that of a country nearer but weaker.[7] That there was ground for this fear is shown by a cool statement of the London *Times:*

> . . . the certainty that the Floridas must belong to the United States, brings with it an invincible necessity for the acquisition of Cuba by the British crown. . . . The two transactions are necessary parts of the same whole, and must, if possible, be put out of hand together.[8]

By 1823 Jefferson had given up hope of annexing the island and aspired only to keep it from falling into British hands, by supporting its independence.[9]

J. Q. Adams was more hopeful of ultimate union, and in a far-sighted statement to the Spanish minister he set forth the reasons for the ambitions of his country:

> . . . [Cuba's] commanding position, with reference to the Gulf of Mexico and the West India seas; the character of its population; its situation midway between our southern coast and the island of St. Domingo; its safe and capacious harbor of the Havana, fronting a long line of our shores destitute of the same advantage; the nature of its productions and of its wants, furnishing the supplies and needing the returns of a commerce immensely profitable and mutually beneficial,—give it an importance in the sum of our national interests with which that of no other foreign territory can be compared. . . .[10]

So strong were his convictions that before the end of his term in office he sent as minister to Spain his confidential friend, A. H. Everett, who immediately began sounding the government as to its willingness to surrender the island to the United States as security for a loan of twenty million dollars without interest, payable at the pleasure of the Spanish government.[11] By thus adopting the methods of loan sharks Everett hoped to foreclose at some future date.

The bugbear of European aggression was momentarily submerged in a flood of fears lest Cuba become prematurely independent. In the heat of winning independence for Mexico and Colombia, Bolivar proposed to strike at the mother country through her only remaining loyal possessions in the New World, Cuba and Porto Rico (Fig. 1).[12] In a panic the Secretary of State, Henry Clay, undertook to beg the Russian government to induce Spain to give up her futile efforts to reconquer Mexico and Colombia.[13] Simultaneous overtures to the republics themselves resulted in relinquishment of their project, and the United States was freed from further apprehension in that quarter. The ever-present possibility of European action

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[7] Semple, *op. cit.*, p. 403.

[8] Quoted in *Niles' Weekly Register*, Vol. 17, January 8, 1820, p. 305.

[9] Jefferson to Monroe, October 24, 1823, in Writings, Monticello edit., 20 vols., Washington, D. C., 1904–05; reference in Vol. 15, p. 479.

[10] Adams to Nelson, April 28, 1823, *32nd Congr., 1st Sess., House of Repr. Ex. Doc. No. 121*, p. 6.

[11] Everett to Adams, cited in "Cuba without War," *Scribner's Monthly*, Vol. 11, 1875–76, pp. 876–879.

[12] Number Four of the announced purposes of the Panama Congress of 1826, quoted in Chadwick, *op. cit.*, p. 210.

[13] Clay to Middleton, May 10, 1825, in "American State Papers, Class I, Foreign Relations," Vol. 5, 1858, pp. 846–849.

kept the State Department on the anxious seat as now and again British or French war vessels would make visits to Cuban waters. Spain was repeatedly warned that the United States would not tolerate the acquisition of Cuba by any other power,[14] and intimations of the same tenor were conveyed to the governments of Great Britain and France.[15]

Complications of the Slave Question

A further political complication in American relations with Cuba made its appearance about 1825 and had thenceforth to be seriously reckoned with. This was the fact that slaves were held in Cuba with profit. To the slave-holding oligarchy in the Southern States this appealed in two aspects: first, they expected and dreaded emancipation of Cuban slaves in case the island were taken over by any of the countries which seemed likely to desire it; second, they feared that independence would lead to the installation of a negro state. In either case the example to slaves on the near-by continent would be dangerous to their masters. Clay hinted at the existence of this sentiment in his Russian letter.[16] As time went on it received more concise statement in the mouths of various leaders who were in sympathy with the dominant South. A letter from Webster to the American consul at Havana is typical:

> It is alleged that the British ministry and abolition societies . . . are . . . offering independence to the creoles, on condition that they will unite with the colored people in effecting a general emancipation of the slaves, and in converting the government into a *black military republic*, under British protection. . . . With 600,000 blacks in Cuba, and 800,000 in her West India islands, [Britain] will, it is said, strike a deathblow at the existence of slavery in the United States.[17]

This indicates clearly that while the fear of British control of the island was still present in the public mind, fear of British interference with the slave system had become far more potent; until 1860 it continued to be the dominant motive in the Cuban policy of the United States. After the Mexican War, when the slaveholders were flushed with victory and the mind of the whole country was favorably disposed toward further expansion, the administration was moved to put forth renewed efforts to annex the coveted island. President Polk and his cabinet determined to offer Spain a hundred million dollars,[18] but in the letter of authorization sent to the Spanish minister the urgent motive for desiring the cession was not mentioned, military expediency and commercial value being the assigned causes.[19]

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[14] Chadwick, *op. cit.*, p. 220. Van Buren to Van Ness, *32nd Congr., 1st Sess., House of Repr. Ex. Doc. No. 121*, p. 26.

[15] Stevenson to Forsyth, *ibid.*, p. 33.

[16] Work cited in footnote 13.

[17] Webster to Campbell, January 14, 1843, marked "Private and confidential," *32nd Congr. 1st Sess., House of Repr. Ex. Doc. No. 121*, p. 39.

[18] M. M. Quaife, edit.: The Diary of James K. Polk During His Presidency, 1845 to 1849, 4 vols., Chicago, 1910; reference in Vol. 3, pp. 469–493, *passim*.

[19] Buchanan to Saunders, June 17, 1848, *32nd Congr., 1st Sess., House of Repr. Ex. Doc. No. 121*, pp. 42–49.

The rejection by Spain of this offer in no wise discouraged the Southern leaders, who, until the outbreak of the Civil War, never relaxed their efforts to possess themselves of the island. To a proposal by France and Great Britain of a tripartite guarantee of the existing régime in Cuba, they argued the special strategic and commercial interests of the United States as the excuse for prospective annexation:

> . . . it would seem impossible for any one who reflects upon the events glanced at in this note to mistake the law of American growth and progress, or think it can be ultimately arrested by a convention like that proposed. In the judgment of the President, it would be as easy to throw a dam from Cape Florida to Cuba, in the hope of stopping the flow of the gulf stream, as to attempt, by a compact like this, to fix the fortunes of Cuba "now and for hereafter." . . .[20]

The Ostend Manifesto

The climax of this frenzy for annexation came with the Ostend Manifesto and its consequent agitation: in the autumn of 1854 the ministers of the United States to Great Britain, France, and Spain—two of them Southerners and the third completely in sympathy with the South—sent to the Secretary of State a letter advocating seizure of the island. It is notable for its extreme frankness:

> Indeed the Union can never enjoy repose, nor possess reliable security, as long as Cuba is not embraced within its boundaries. . . .
>
> After we shall have offered Spain a price for Cuba far beyond its present value, and this shall have been refused, . . . then, by every law, human and divine, we shall be justified in wresting it from Spain, if we possess the power; and this upon the very same principle that would justify an individual in tearing down the burning house of his neighbor if there were no other means of preventing the flames from destroying his own home.[21]

The publication of this rash statement was fervently received in the United States, and throughout the winter the war spirit was fanned by the newspapers, especially by the Washington (D. C.) *Union*, a sheet controlled by a close friend of Buchanan, one of the authors of the Manifesto.[22] Anticipating repudiation by the North, the administration refused to take the proposed steps without provocation by Spain, and the effort came to nothing.[23] Buchanan afterward sought to use his presidential office to gain the desired end, and the Southern periodicals did not cease discussing the Cuban situation from all angles.[24]

Trade Relations and Cuban "Insurrectos"

An interest of increasing importance was the commercial development. Of Cuban exports of the day—sugar, copper ore, coffee, tobacco[25]—the

[20] Edward Everett to the Comte de Sartiges, December 1, 1852, in "Correspondence on the Proposed Tripartite Convention Relative to Cuba," Boston, 1853, pp. 42–43.

[21] Buchanan, Mason, and Soulé to Marcy, October 5, 1854; quoted in Chadwick, *op. cit.*, pp. 263, 266.

[22] Sidney Webster: Mr. Marcy, the Cuban Question and the Ostend Manifesto, *Political Sci. Quart.*, Vol. 8, 1893, pp. 1–32; reference on pp. 26–27.

[23] Marcy to Shepard, April 15, 1855; quoted in J. B. Moore: The Question of Cuban Belligerency, *Forum*, Vol. 21, 1896, pp. 288–300; reference on p. 300.

[24] *De Bow's Review* and *Southern Quarterly Review*, *passim*.

[25] *Hunt's Merchants' Magazine*, Vol. 7, 1842, p. 330.

United States perennially consumed more than all other countries combined. Of imports the United States contributed a smaller share, chiefly because of the excessive tariffs levied by Spain on all goods of foreign origin: breadstuffs and manufactured goods were at the outset and consistently have remained the staples of the import trade.[26] A long succession of prosperous years in Cuba, unaffected even by the panic of 1837 and interrupted only by a revolt in 1828, came to an end in 1844 with a drought followed by a destructive hurricane.[27]

The succeeding depression worked hardship which naturally enough was laid to the door of the Spanish tariff laws. The discontent awakened a sympathetic response in the United States, and in 1849 Cuban *insurrectos* for the first time enlisted American citizens in their plans and used American ports as naval bases for filibustering expeditions. The first such venture was suppressed by United States authorities in New York, and the agitators consequently moved their headquarters to New Orleans, nearer the scene of operations and in the heart of the sympathetic Southland. Subsequent failure of co-operation in Cuba led to seizure of the conspirators by the Spanish authorities (in 1851), but their connection with the United States so exasperated these officials that American ships calling at ports of the island were subjected to numerous annoyances, culminating in the confiscation of the cargo of the *Black Warrior* in 1854. A tardy apology closed the incident, and the next few years saw an unprecedented expansion of trade between island and mainland. The financial crisis of 1857 and the Civil War played havoc with this business, but the Cuban trade recovered more quickly than did commerce between the United States and other countries. In 1864 it registered more than a tenth of the total, the highest percentage ever reached. In general, the Cuban question was quiescent during the Civil War, more nearly a dead issue than at any other period since 1800.

Cuban Insurrections After the Civil War

In the United States the years which followed the Civil War were marked by the ascendancy of commercial and manufacturing interests. The republic had outgrown its childhood fears of British or French aggression; the continuance or abolition of slavery in Cuba was no longer an issue; but as a source of tropical products and as a market for the growing production of the United States the island took on a fresh importance. The keen-minded business men of the new United States grasped clearly the vital issue:

> The material development of Cuba . . . is chiefly due to its proximity to the United States. From the latter she has acquired the impulse to act, and the fever of enterprise. She has obtained at a small cost, on account of the nearness of the coasts, the numberless mechanical implements to reduce the laborers in the manufactories of sugar, and to convey it quickly to the coast. . . . Without that [United States] market of thirty millions of peo-

[26] *Ibid.*, Vol. 40, 1859, p. 280.

[27] D. P. Bailey: The Currency and Commerce of Cuba, *Banker's Magazine*, Vol. 35, 1880–81, pp. 697–704; reference on p. 699.

ple, Cuba's production would have remained wretchedly small. . . . Her well-being is not altered through Spain's disturbances, but by the pecuniary circumstances of Anglo-American merchants. . . .[28]

Contingencies affecting the commerce between the two countries were bound to react sharply upon their political relations. This is admirably illustrated by a comparison of the two insurrections which raged during the period. The first of these broke out in 1869 and continued intermittently for ten years; the second flamed forth in 1895 and was followed by the war between the United States and Spain in 1898. The two bear striking superficial likeness: both were fomented by Cubans resident in Cuba and abetted by Cubans resident in the United States; both began in the eastern end of the island and spread westward; both were carried on by guerrilla warfare and the destruction of property, especially sugar plantations; both involved a small number of Americans who insisted on lending aid to the *insurrectos;* both were marked by destruction of the lives and property of American citizens—acts which led to serious diplomatic crises. Why was one allowed to drag on for ten horrible years, whereas the other led to speedy intervention? Upon the answer hangs the solution of the problem under consideration, for if non-geographic factors are shown to be of major importance, the "politico-geographical law of gravity" must be declared unconstitutional, as least so far as this case is concerned.

A careful study of conditions between 1865 and 1896 shows that the similarity between the two insurrections was apparent rather than real, for in several essential particulars the fifteen years which elapsed between them altered the state of affairs. During the Ten Years War one of the shrewdest editors in the United States repeatedly declared that there was no sympathy with the Cubans except among "manufacturers of issues."[29] To be sure, the country was brought to a war pitch in 1873 by the capture of a vessel (the *Virginius*) flying the American flag and the summary execution of fifty of her passengers, but the excitement had so far died out three years later that the same editor could affirm that only the yellow press desired intervention and that there was less war spirit in the country than at any time within the previous fifty years.[30] Moreover, this was the very year in which President Grant made a gesture to end the contest by threatening intervention, on the ground that American property was being destroyed, that American commerce was being interfered with, that political exiles were taking refuge in the United States where they became disturbers of the peace, and that world-wide ideals of humanity were being violated.[31] The threat was not followed by action, apparently because the list of grievances stirred no response among the American people. The revolutionists held only a small part of the eastern end of the island, much of which

[28] Spain and Cuba: The Geneva Pamphlet on the Relations Between Spain and Cuba, New York, 1876, p. 36.

[29] *The Nation*, Vol. 9, 1869, p. 24.

[30] *Ibid.*, Vol. 21, 1875, pp. 335–336.

[31] Fish to Cushing, "Paper No. 266," *44th Congr., 1st Sess., House of Repr. Ex. Doc. No. 90*, pp. 3–12.

was in a state of nature, and their depredations on the property of American citizens were confined to burning cane fields belonging to those who refused to pay blackmail. Even planters whose fields were ravaged suffered little, for cane is only slightly damaged if ground within a fortnight after burning.[32] Furthermore, in spite of some interference with commerce, there was no serious disturbance of trade, for the total foreign commerce increased during the insurrection,[33] and that with the United States reached in 1874 the highest figure, with one exception, ever attained during the Spanish ascendancy. Moreover, the drop in 1875 can as well be charged against the panic of 1873 as against the Cuban insurrection. This singular prosperity in war time and in the theater of operations can be explained in part by the facts that the revolutionists held not a single port, even in their eastern stronghold, and that the greater part of the wealth and population was in the western end of the island, the district never threatened by revolt.[34] While it is true that the disturbances drove many political refugees to the shelter of the neighboring States, especially planters of native birth whose sympathy with the insurrection had cost them their property, yet their propaganda was so ill-organized before 1890 that they cannot have been very troublesome to the American government. Finally, the sentiment of humanitarianism was not sufficiently developed to lend support to intervention.[35]

Growth of Commercial and Social Relations

During the interval between the two revolts, however, all this was changed. The property holdings of Americans in the island increased amazingly; the confiscated lands of exiled "patriots" attracted the surplus capital of those who prospered under the post-bellum régime in the United States. President Cleveland estimated that in 1896 thirty to fifty million dollars of American money were invested in Cuban plantations, railroads, and mines.[36] Of this amount, some ten or fifteen million seem to have been in the form of advances by American merchants upon the sugar crop of 1896.[37] Commerce between the two countries displayed an equally astonishing increase. Immediately after the close of the Ten Years War there was a sharp slump, it is true, but this was in part a reflex of the poor state of the general foreign trade of the United States and in part a consequence of unsettled economic conditions in Cuba arising from the abolition of slavery and from increased taxation,—both concomitants of the war. After 1885

[32] Murat Halstead: Our Cuban Neighbors and Their Struggle for Liberty, *Amer. Rev. of Reviews*, Vol. 13, 1896, pp. 419–438; reference on p. 420. See also *The Nation*, Vol. 22, 1876, p. 110.

[33] Memorandum of Fernando Calderon y Collantes to Secretary Fish, February 3, 1876; *54th Congr., 1st Sess., Senate Doc. No. 213*, pp. 50–54.

[34] *Ibid.*

[35] *The Nation*, Vol. 9, 1869, p. 24; Vol. 21, 1875, pp. 335–336.

[36] Annual Message of December 7, 1896; in J. D. Richardson: A Compilation of Messages and Papers of the Presidents, 1789–1897, 10 vols., published by authority of Congress, 1898; reference in Vol. 9, p. 718.

[37] A. S. Hershey: The Recognition of Cuban Belligerency, *Annals Amer. Acad. of Polit. and Soc. Sci.*, Vol. 7, 1896, pp. 450–461; reference on p. 457, note.

trade increased by leaps until 1893, when it reached its maximum for the century. The great volume of commerce in this year was due to reciprocity between the United States and Spain, which became partially effective in July, 1891, and fully operative in July, 1892. By the terms of this arrangement sugar, cacao, coffee, hides, coal, petroleum, and machinery were allowed shipment free of duty, and the tariff on flour was reduced fifty per cent.[38] Since these were the principal items of trade between island and mainland,[39] the physical environment for the first time was given unrestricted play, and the results showed how harmful had been the self-seeking policy of Spain. The British consul general at Havana complained that "under the recent reciprocity treaty the United States of America practically supplies all the wants of the island and receives all its produce."[40] Since this trade was carried almost wholly in American bottoms, American shipping interests were benefited by the increase.[41]

Not only were the economic interests of the United States in Cuba broadened between 1879 and 1895, but less material bonds likewise were strengthened. On account of the proximity of the United States to their island, wealthy Cubans had for long sent their children here to be educated. After the failure of the revolt of 1869–1879 many of its leaders migrated to the continent. Numbers of them became citizens of the United States, and nearly all engaged in furthering the interests of the anti-Spanish group in Cuba. By 1892 it was said that most of the "patriots" were in New York and Florida, there being no organized revolutionary party in Cuba itself.[42] The inevitable consequence of the expanding economic and social intercourse between mainland and island was augmented interest on the part of the Americans in the affairs of Cuba.

The Insurrection of 1895

Such, then, was the situation in February, 1895, when insurrection once more broke out in eastern Cuba It is generally agreed that the cause of the upflare was economic distress. The panic of 1893 marked the beginning, and the slump in foreign trade thus occasioned was intensified by the abrogation of reciprocity in 1894. At about the same time the beet sugar of central and western United States was becoming a formidable competitor of cane sugar. The sudden contraction of the market resulted in throwing out of work great numbers of Cuban plantation laborers, who formed the arm of the movement whose head was in New York—the so-called Junta. This clique had long been preparing for the eventuality now at hand: "trunkfuls of Cuban bonds," payable upon recognition of the

[38] "Reciprocity with Spain," *Quart. Register of Current History*, Vol. 1, 1891–92, pp. 218–220.

[39] The Foreign Commerce and Navigation of the United States, 1906, U. S. Dept. of Commerce and Labor, pp. 78–79.

[40] Quoted by E. S. Gould: Commercial Relations between Cuba and the United States, *Engineering Mag.*, Vol. 7, 1894, pp. 500–508; reference on p. 504.

[41] Thomas Jordan: Why we Need Cuba, *Forum*, Vol. 11, 1891, pp. 559–567; reference on pp. 562–563.

[42] Rollo Ogden: Spain, Cuba, and the United States, *Chautauquan*, Vol. 14, 1891–92, pp. 565–569; reference on p. 567.

Cuban Republic by Congress, had been distributed gratis among journalists and sold to Cuban sympathizers at three to ten cents on the dollar;[43] arms and ammunition had been collected; and filibustering expeditions had been arranged. When once the insurrection was under way, stores were smuggled out of United States ports, and isolated points along its fifty-five hundred miles of coast line south of New York (Fig. 1) were used as outfitting stations for seventy-one reported filibusters. These were aided greatly by the lonely keys of Florida. "It was the proximity of the United States and not merely Cuban energy, supported by the popular good-will of the country, which made the Union the principal source of Cuban supply. Exactly the same elements that made the close and extensive commercial relations in time of peace caused the active commerce in war material in the time of war.[44] . . ."

The difficulties confronting the United States government that arose from Cuban scheming were heightened by the acts of individual Americans. Several newspaper reporters in Cuba were harshly treated by the Spanish officials there; a Philadelphian importer of bananas, "finding his business destroyed by the outbreak of the revolution, promptly turned his ships into filibusters, and, after landing many cargoes of arms and ammunition, was eventually tried and convicted in a United States court;"[45] the action of other captains of American ships was from time to time so suspicious that the Cuban authorities were led to take unwarranted protective measures.

While relations with the United States were thus becoming strained, the utmost exertions of Spain were insufficient to cope with the insurrection. Tropical diseases decimated troops fresh from Europe, and the rugged and forested country enabled the natives to wage deadly guerrilla warfare.[46] As in the Ten Years War, the revolt originated in the east; but this time it spread rapidly westward until the glare of burning cane fields could be seen from Havana. The policy of the insurgents was to destroy all cane fields and sugar-refining machinery; the policy of the Spanish was to starve the revolt by cutting off importations of food and preventing agriculture except within the Spanish lines. Thus caught between two enemies, trade continued to dwindle, until in 1897 the United States was doing less business with Cuba than in any year for four decades. Even the American intervention, which, by severing formal commercial relations, in the next year reduced commerce to its lowest ebb since 1850, induced only a relatively slight diminution in the total volume of trade, and the exports of Cuban goods actually increased. Americans who had plantations on the island stood to lose not only the revenue from them but all movable property as well, and the advances on the sugar crop amounted to a dead loss. Natur-

[43] *The Nation*, Vol. 66, 1898, p. 255.
[44] Chadwick, *op. cit.*, p. 419.
[45] R. T. Hill: Cuba and Porto Rico, New York, 1898, p. 81.
[46] T. Estrada Palma to Secretary Olney, December 7, 1895, *54th Congr., 1st Sess., Senate Document No. 166*, p. 13.

ally, injured Americans were bitter in their complaints; and the story of pecuniary loss frequently involved a tale of horrible outrage, such as generally accompanies guerrilla fighting. Public opinion in the United States demanded mitigation of the evils, and this temper was judiciously inflamed by politicians with ulterior motives[47] and by the yellow press.[48] The matter could not be kept out of Congress, which by resolution urged the President to take a stand (February–April, 1896).[49] The election platforms of both parties contained provisions committing their adherents to put an end to the Cuban disturbances, and, although the issue was buried under the avalanche of free silver, it remained—the index to an unavoidable predicament, viz.: the geographic proximity of Cuba. In his last annual message, President Cleveland felt compelled to devote considerable attention to Cuba.

> Were the Spanish armies able to meet their antagonists in the open or in pitched battle prompt and decisive results might be looked for, and the immense superiority of the Spanish forces in numbers, discipline, and equipment could hardly fail to tell greatly to their advantage. But they are called upon to face a foe that shuns general engagements, that can choose and does choose its own ground, that from the nature of the country is visible or invisible at pleasure, and that fights only from ambuscade and when all the advantages of position and numbers are on its side. In a country where all that is indispensable to life in the way of food, clothing, and shelter is so easily obtainable, especially by those born and bred on the soil, it is obvious that there is hardly a limit to the time during which hostilities of this sort may be prolonged.[50]

Intervention

The new administration turned at once to the task of settling the difficulty on a peaceful basis, but the President's efforts were nullified by the political parties, which were now racing to see which could gain the credit of snatching Cuba from the weakening grasp of Spain. The destruction of the United States battleship *Maine* in Havana harbor on February 15, 1898, heightened popular excitement and led directly to the crisis of April. On the eleventh of that month, McKinley sent a war message to Congress, carefully omitting mention of the future status of the island. The Republican House of Representatives responded dutifully; but in the Senate, where the interests of the Democratic West and South were stronger, a conflict occurred.[51] Besides the western and southern sugar-growers' fear of competition should Cuba become a part of the United States, there was in these sections a sincere desire to give the island its long-sought independence. The Democratic and Populist senators managed to have inserted in the resolutions calling for intervention, the following provisions:

> That the people of the Island of Cuba are, and of right ought to be, free and independent.
> That the United States hereby disclaims any disposition or intention to exercise sover-

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[47] *The Nation*, Vol. 61, 1895, pp. 250–251.

[48] H. S. Pritchett: Some Recollections of President McKinley and the Cuban Intervention, *North American Rev.*, Vol. 189, 1909, pp. 397–403.

[49] *Congressional Record*, Vol. 28, Part II, pp. 1317 *et seq.*

[50] Annual Message, December 7, 1896, *loc. cit.*, p. 717.

[51] *Outlook*, Vol. 58, 1898, April 23, pp. 995–996.

eignty, jurisdiction, or control over said island except for the pacification thereof, and asserts its determination, when that is accomplished, to leave the government and control of the Island to its people.[52]

Thus committed to a reversal of its century-old policy, the United States government entered the lists against Spain.

The War with Spain

The geographic basis of the strategy of warfare is universally recognized. It therefore is unnecessary to discuss the operations of the War with Spain in detail.

Because of the insular character of the bone of contention, the issue was staked inevitably on a naval struggle. At the outset Spain had a slight preponderance of available naval strength, but this was more than offset by the necessity of fighting at arm's length across the Atlantic, a necessity which arose from the position of Cuba, close to the United States. Conversely, the American navy could operate from a base at home. The land operations were made possible by the fleet, and, while they aided in forcing an early conclusion of hostilities, the Spanish cause finally was lost in the naval battle of Santiago.[53] Within a month of the capitulation of Santiago preliminary terms of peace were signed, and Cuba was made over to the keeping of the United States.

Cuba As a Dependency of the United States

As has been stated above, Congress, by a self-denying ordinance on the eve of the war, had disclaimed a desire to annex the island. Since this ordinance had been passed in response to the traditions and idealism of the American people, and in opposition to dominant economic interests, an important group in the country by no means considered Cuba's status settled thereby. Foiled in gaining complete control, this section of the public succeeded in passing through Congress as an amendment to an army appropriation bill certain provisions which Cuba was compelled to incorporate into her constitution before the American military occupation would be terminated. By these articles Cuba agreed to contract no debts beyond her interest-paying power nor otherwise to impair her independence; to permit the United States government "to intervene for the preservation of Cuban independence, the maintenance of a government adequate for the protection of life, property, and individual liberty . . ."; and to sell or lease lands necessary for coaling or naval stations of the United States.[54] These conditions having been complied with, the American troops were withdrawn in the spring of 1902. Thus the United States saved its face

[52] *The Statutes at Large of the United States of America*, Vol. 30, 1899, Washington, D. C., pp. 738–739.

[53] The most useful writings on operations of the war are A. T. Mahan: Lessons of the War with Spain, Boston, 1899, and F. E. Chadwick: The Relations of the United States and Spain—The Spanish-American War, 2 vols., New York, 1911.

[54] The so-called Platt Amendment, passed March 2, 1901, *The Statutes at Large of the United States of America*, Vol. 31, 1901, Washington, D. C., pp. 897, 898.

before the world and at the same time safeguarded interests imposed on it by geography.

Proof that Cuba had not become independent but had only changed masters, appeared in 1906 when a revolution gave provocation for intervention in the destruction of property and excuse for it under the terms of the Platt Amendment. Troops were sent in to occupy the island, and there was widespread agitation among "planters, commercial men, and promoters" in the United States to have their government assume permanent administration of Cuban affairs.[55] The public felt, however, that the country was pledged to let Cuba work out its own destiny. Since stable native government satisfied most of the American interests there, the troops were withdrawn as soon as order was re-established.

A period of financial maladministration which threatened the economic prosperity of the island culminated in 1912 in election frauds and a second revolution. This time the American government dictated the selection of the chief executive under the guns of United States marines. There seems to have been less clamor for annexation than on the previous occasion. A third disturbance, likewise the outcome of a disputed presidential election, occurred in 1917. The United States again evidenced its intention to keep a firm rein upon its little neighbor, by giving the established government its moral support, backed by shipments of arms and ammunition and by the landing of marines at Santiago "to protect foreign interests."[56]

Effect of the World War

The World War greatly stimulated sugar production in Cuba in three ways: it eliminated from the world market most of the beet sugar of Europe; it increased the demand, partly as substitution for alcoholic liquor, partly as an army staple, and partly for the manufacture of munitions; and it reduced shipping to a point which cut off the East Indies as a competitor in the Atlantic hemisphere. Under this stimulus foreign money, mostly American, was drawn into the business of increasing the Cuban output at a greatly accelerated rate. In 1919 there were 196 refineries in Cuba, of which 70 were owned by Cuban, 62 by American, and the remainder by other foreign capitalists. The Cuban mills were mostly small, and more than half the output came from American factories, which represented about half the total fixed investment in the business. Three-fourths of the total product was shipped to the United States.[57]

Under the influence of these conditions and of war prices fortunes were made by the score, and Havana became a resort of bonanza kings. For sound economic reasons Cuba followed the United States into war, and the

[55] J. W. Foster: The Annexation of Cuba, *The Independent*, Vol. 61, 1906, pp. 965–968; reference on p. 966.

[56] "The Insurrection in Cuba," *Amer. Rev. of Reviews*, Vol. 55, 1917, p. 413. Cf. *The Independent*, Vol. 89, 1917, p. 344.

[57] W. J. Showalter: Cuba—The Sugar Mill of the Antilles, *Natl. Geogr. Mag.*, Vol. 38, 1920, pp. 1–33; W. W. Rasor: The Supremacy of the Sugar Industry in Cuba, *Pan-American Mag.*, Vol. 29, 1919, pp. 242–246. See also the preceding article, by R. H. Whitbeck, in this number of the *Review*.

fiscal machinery was geared to that of the continental republic. The Cuban National Bank, which had been established in 1905, was able to fix the standard of the Cuban dollar at the level maintained by the United States for its currency, and United States money, even to Federal Reserve bank notes, was made legal tender in Cuba.[58] Cuban sugar producers spent their summers in the Adirondacks, their fortunes in New York, and sent their children to eastern schools. A new interest in the English language sprang up throughout the island. It became evident that economic and social forms were shaping to the pattern of the physical environment. Political affairs could not hold aloof. Gradually party issues in Cuba came to center about future relations with the United States. The Conservative group supported the Platt Amendment, albeit urging that it be put in form of a treaty.[59]

Progress Toward Stability

The Liberal group opposed further interference by the United States, but agreed with their rivals that economic stability must be insured.[60] As an outcome of this discussion the Judge Advocate General of the United States Army was called in to formulate an election law which should guard against the disturbances that had marred every election held under native authority, save one, and which had more than once resulted in intervention. On the basis of this law, which was approved in August, 1919, the election of 1920 was held. Unfortunately it occurred when the country was suffering the sharp pains of sugar deflation, and the usual disputes and threats of revolt followed. Once again the United States was forced to intervene, but this time a single arbiter was sent instead of a detachment of marines. His efforts to compromise the dispute were successful. Thanks to financial aid from the United States Federal Reserve Bank the economic crisis was safely passed, and Cuba once more regained fiscal and political equilibrium.

By these means Cuba has arrived at a stage of economic, social, and political co-operation with the United States which seems to assure her a prosperous future. Although technically independent, it can hardly be asserted that her sovereignty is not in the safe-keeping of the United States, which for a century has hoped and schemed for some such outcome. The extirpation of yellow fever, the establishment of schools, the development of public works, and, above all, the stabilizing of finances and the assurance of security to person and to property, are all the result of meddling on the part of the United States. Because of these constructive measures trade has flourished, and wealth has replaced poverty.[61]

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[58] W. H. Morales: Finance in Cuba, *Pan-American Mag.*, Vol. 27, 1918, pp. 147–148; George Marvin: Keeping Cuba Libre, *World's Work*, Vol. 34, 1917, pp. 553–567.

[59] "A Cuban View of the Platt Amendment," *Amer. Rev. of Reviews*, Vol. 56, 1917, pp. 530–540.

[60] "Cuban Criticism of the Platt Amendment," *ibid.*, Vol. 60, 1919, p. 95.

[61] M. G. Menocal: Leonard Wood As Administrator, *Forum*, Vol. 63, 1920, pp. 277–278; W. J. Showalter, *op. cit.*, p. 12.

Solution of the Problem

In summarizing the foregoing discussion, it may be noted: first, that the United States always has desired to control Cuba; second, that during the years when it was too weak to seize the island outright, it effectually prevented any other power from filching it from Spain; third, that then followed a period when the tempting morsel would have been snapped up, had not internal division in America nullified all efforts to that end; fourth, that after unity was once more established, no conditions within Cuba stirred her neighbor to action until American economic interests in the island had experienced marked development; fifth, that these economic interests focussed attention upon the inhuman treatment being received by Cubans; and sixth, that when intervention had brought about control, that control was completely effective, in spite of limitations cast about it by the very humanitarianism which had been invoked to make intervention possible. Throughout these political ins and outs, the physical environment was playing its constant part. All the economic conditions were derived directly from it. The social interrelations, such as the rise of humanitarianism, are less obviously based on geography. And yet other nations as powerful and as civilized as the United States failed to be stirred to the point of intervention by Spanish barbarities, and the United States has at times withstood the temptation to intervene in behalf of equally abused but more remote peoples. The relations of Cuba and the United States prior to 1898 seem therefore to have been dictated, in all their larger aspects, by geography. The swiftness of the conclusion of the War with Spain seems clearly to have rested on environmental conditions, although the immensely greater force of the United States would hardly have failed to bear Spain down in time, under any circumstances. Since the war the geographic relation has urged the United States to set up and maintain a standard of government below which Cuba may not fall on penalty of subversion of her autonomy.

Finally, therefore, it may be concluded that, since Cuba was a strategically and economically important island, lying near a powerful continental neighbor but under the political control of a weak and remote country, and since geographic factors have been of basic importance in breaking those political ties and in bringing and maintaining Cuba under the suzerainty of the United States, the "politico-geographical law of gravity" stands in this instance as valid.

PREHISTORIC GEOGRAPHY

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Fascinating as it is, the geography of the present is far less attractive than the geography of the past. In studying a modern region, for instance, we already know the facts—the areas of densest population and so forth—before we begin work. But before we can begin to generalize geographically about such a region as it was during some prehistoric period, the facts have first to be discovered, collected, classified, and mapped. It is not until this preliminary—and very laborious—research has been accomplished, that the archeologist is in a position to study the geographical aspect of his chosen period. Neither of these tasks can profitably be carried out by amateurs. Only long practice in the field can qualify for the delicate business of selection; and it is only by the informed imagination of the specialist that the distribution map can be adequately interpreted. This map is the goal of the whole undertaking, and its explanation in terms of geographical influence is one of the finest intellectual pleasures that exist.

The Geographic Factor in the Determination of Ancient Settlements and Trade Centers

The geographical features which emerge from such research are of two kinds. In the first place, and this is especially the case in dealing with prehistoric times, the facts whose distribution has been mapped fall into a number of distinct groups, which indicate the chief settlement areas of the period. In the second place the distribution indicates the existence of certain "nodal" points, many of which have now lost their nodality through a change in the nature of the control.

Let me take as an illustration the changes which have taken place in the distribution of population in England and Wales since the New Stone Age. We know from the distribution of Long Barrows that at the close of the Neolithic period, the uplands of the Cotswolds and the bare chalk downs of Wiltshire and Dorset were the most thickly inhabited regions of Southern England; and from the close association of these remains with springs and streams we can infer—what was obvious on a priori grounds—that within these regions the population clustered more thickly round those regions where water was easily accessible. Only by such a common sense hypothesis can we explain the existing distribution and, what is equally striking, the small bare patches (still within the group area) where Long Barrows are absent.

Influence of the Geological Formation and the Water Supply

In the above instance two controlling factors can be discovered. The control of the groups as a whole is indirectly geological; primitive man selected those regions which were free from dense forest and marsh and which also provided good open pasture land to graze his flocks and herds upon. Graphically it may be expressed thus:

Geology→vegetation→domesticated animals→man.

Altitude may also exercise a controlling influence, as it does in the Welsh mountains. The second control is exercised *within* the group area by the universal need of water for man and beast.

A study of distributions during the succeeding period shows that in the main the same régime obtained. That was to be expected since the discovery of metal did not for a long time to come affect the fundamental needs which regulate social life. But the use of metal implements coincided with, and was no doubt partly the cause of, a great development of trade. The inhabitants of areas devoid of metal ores demanded, and were prosperous enough to pay for, such valuable tools; and their distribution reveals, outside the great settlement areas, little groups of finds at points of geographical importance. Among such are the harbors, especially those at the mouths of rivers whose valleys were a natural avenue of approach to the inland settlement areas. It is here that we see most clearly the different working of the geographical factor in past and present.

Examples of Ancient British Ports

In the Bronze Age, if not before, the principal ports on the southern coast of England were at Bitterne on the eastern shore of the Itchen estuary in Hampshire, at Christchurch in the same county, and at Weymouth. Warrington, near the mouth of the Mersey, was also an important port. Of these four sites the first is still important, but the settlement is now concentrated at Southampton on the western shore of the Itchen; the second, Christchurch, has ceased to be a port; the third, Weymouth, occupies a spot probably to the north of the original settlement and is of far less *relative* importance than its prehistoric predecessor; and the fourth, at Warrington, has been superseded by the port at Liverpool farther down the river. Now of these four we may perhaps select Christchurch and Weymouth as the most important in prehistoric times, because they were the natural outlets of two of the largest and then most thickly inhabited regions —Salisbury Plain and Dorset. The people of these regions could obtain metal implements only by exchanging them for products of their own fertile districts; land communication being difficult and hazardous, we should naturally expect to find that sea routes predominated, and that the ports of call were those nearest to the region of the buyers. That is what the

evidence of distribution does in fact suggest in a way that amounts almost to proof. We may go so far as to say that the raw metal was exported, from Cornwall or Brittany or both, to Southampton and probably also Christchurch and was there smelted on the spot and cast into molds for axes. Positive evidence (still unpublished), consisting of the discovery of a crucible with bronze axes near Southampton, places this conclusion beyond doubt; and as a matter of fact the writer had arrived at it before this crucible was known to him, from the discovery in the same neighborhood of

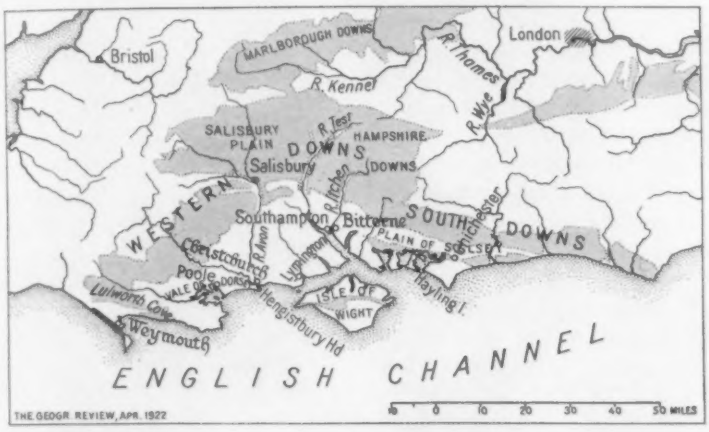

FIG. 1—Map of a part of southern England showing the site of three important ports of the Bronze Age (in antique lettering) in relation to the hinterland. The open chalk upland (shaded) was the seat of the densest population. Compare with the map of the habitable area of southern Britain in Neolithic time by H. J. Fleure, *Geographical Review*, Vol. 5, 1918, p. 219.

several "hoards" of bronze axes, newly cast and ready for transport to the inland marts. Closely allied to this discovery is that made at Hengistbury Head, within the area of a prehistoric camp, where remains of iron smelting were found. Their exact age is a little uncertain, and they belong of course to a later date than the bronze axes; but abundant relics of the Early Iron Age were found there, and we may safely assume that Hengistbury, which is less than a mile from Christchurch and at the mouth of the Salisbury Avon, was the port through which the people of Salisbury Plain obtained their iron implements before, and possibly during, the Roman occupation.

PORTS AS DETERMINED BY "EFFECTIVE HINTERLAND"

What were the causes which made Christchurch and Warrington, for instance, so much more important in the past than they are now? The increase in the size of ships is not the only one which has operated. Had this been the sole factor we should find it difficult to explain the absence of finds round other "shallow-draught" harbors like Poole and Chichester.

The main factor which determined the selection of ports in prehistoric times was *the presence of a populous hinterland of effective buyers*. The port most accessible to that hinterland was bound to become the gateway through which imported goods entered it. Christchurch was the port of Salisbury Plain, and the broad gravel terrace of the lower Avon valley was its road of approach. Similarly Warrington was the port nearest to that island of population in the Peak District of Derbyshire and the one through which the copper of Ireland was probably obtained. It may also have derived importance from being an important halting place on a trade route between Ireland on the west and Scandinavia on the east.

In both these instances the determining factor is a reduction to a minimum of the land journey. It was this which caused Warrington and not Liverpool to be selected; if you could sail up as far as Warrington and thereby save several miles of land journey, you would certainly have done so in prehistoric times. A mile of sailing up an estuary was as nothing compared with the same distance on land, even if you did not actually carry the heavy ore on your own back (which you or your customers probably did).

Nowadays roads and railways have so altered land communication that a few miles makes no difference. But we may see the same principle—which may be called for short that of the *effective hinterland*—in operation just the same. Good natural harbors, like that of Kingsbridge in Devon, are of little commercial importance because they lead nowhere—neither to population nor natural wealth; but where these exist, as round Manchester, Leith, and Glasgow, artificial harbors have had to be made, or natural ones enlarged, by dock construction, canalization, and dredging.

Causes for Shiftings of Relative Population Densities

But to hark back to the first point, why is it that the settlement areas—that is to say, the regions of densest population—of one period are different from those of another? It is because man, in his rôle of parasite, draws his sustenance now from one host now from another. The ultimate host is always the soil which produces vegetation which supports food-animals; but men may pay other men, in other lands, to supply them with these necessities. In prehistoric times the parasitism was direct; men lived on the country they dwelt in. Consequently the regions most thickly inhabited were those of great *natural* fertility, by which is meant regions immediately open to pasturage and agriculture without much initial expenditure of labor in clearing. The fertility of forest regions may ultimately prove greater, but it is at first potential only and needs much labor to develop. In prehistoric times, therefore, forest regions were relatively thinly populated. Nowadays, though we still live mainly on bread and meat and vegetables, we do not grow enough of these to support the whole of our population. We do not need to, because we can obtain these necessaries in exchange

for coal and all the variety of manufactured articles we produce through its energy. The world-wide demand both for coal itself and for those manufactures which are directly dependent upon it—in short, its general indispensability, unchallenged for a hundred years—has caused in that same short period a shifting of population almost without parallel in any country at any past period. Speaking very broadly, and excluding large towns, it may be said that few sudden changes took place in the distribution of population from the New Stone Age down to the beginning of the nineteenth century.

The most revolutionary change was made by the Anglo-Saxon invaders who deliberately chose to settle in the valleys instead of upon the high downs where the Romano-British and all their predecessors had had their encampments. But even they did not select their regions for any other reason than that of their potential food value; and the chalk regions, as usual, were the favorites. Such changes as took place from then onwards were of the nature of reclamation of wild land; but this process was gradual and did not amount to much in quantity, nor did it cause existing centers of gravity to shift appreciably.

It is a truism that the areas of densest population now coincide with coal fields; it will soon be recognized as a truism that in early prehistoric times they *generally* coincided with limestone areas—chalk, oolite, and carboniferous.

The Geographic Factor in Archeological Method

I have emphasized the geographical influence and its shiftings because that is likely to be of most interest to geographers. To the archeologist, however, it is not so much the fact of the influence as the particular regions in which it expresses itself that matters. The whole subject is in its infancy, and there are many discoveries of the first importance to be made when archeologists realize the value of this method of study. I know of nothing so enthralling as to watch laboriously collected facts gradually sorting themselves out into homogeneous groups. The pleasure is the greater if, as often happens in prehistoric archeology, the individual facts themselves have not previously been recognized as akin. For instance, at the present moment I am engaged in compiling a descriptive list of the Chambered Long Barrows of Southern England. With the exception of two counties[1] no list of any kind existed, and it was necessary to start *ab initio*. In the course of field work many unrecognized and many entirely new examples were found, and the general kinship of all units forming this large group gradually became evident. In the light of experience it became possible to give an intelligible account of many isolated monuments of this class whose real nature had not previously been recognized. This marks the first stage, of collection and classification of instances. The second consists in plotting

[1] Gloucestershire, by G. B. Witts in 1883; and Wiltshire, by Mrs. Cunnington in 1914, the latter being by far the better of the two.

the sites on a map and examining their distribution. When this simple task of mapping is accomplished, one's first act is to superimpose a geological map and to see whether the formations where the sites cluster have any common traits. In the distribution of Long Barrows, as has been hinted above, the common trait is their occurrence upon some kind of limestone, especially near streams and springs. If, as may reasonably be concluded, the distribution of these tribal burial places is a clue to the past distribution of the living members of the tribes, we can proceed to form some tentative generalizations. We can proceed further than this; we can *foretell* that in other regions where similar conditions obtain, Long Barrows or other remains of these people will some day be brought to light; and this raises archeology very nearly to the level of an exact science.

I say "foretell;" the facts may be unknown to science, that is to say they may be unrecorded and known to a few persons only; or they may be entirely unknown. In either instance it amounts to prophecy in the scientific sense if their occurrence in the region in question is unknown to the foreteller. Let me give an instance. Before any excavations at all had been made or contemplated at Hengistbury Head I felt sure that the site was one of the first importance, for reasons which have already been given. Unfortunately I did not record my opinion on paper; but I came very near doing so when I said in 1912 that Christchurch was the port through which the gold of Ireland, so abundant in Wiltshire, must have passed.[2] And, as a matter of fact, the discovery in a round barrow at Hengistbury of a gold button case and other objects of a type common in Wiltshire but rare elsewhere, goes far to prove my contention.

It may reasonably be demanded that this claim to prophecy be justified here and now by concrete examples. I take up this imaginary challenge and give below the kinds of sites, with some specific instances of actual places where I anticipate that discoveries of prehistoric finds will be made or, if already made, will be found, when their distribution is mapped, to cluster most thickly. These prophecies are based on a few already known instances which appear to obey some law of universal application. In the present state of geographical archeological research such prophecy is still possible. That the subject is still in its archaic period is proved by the rarity and the primitive character of archeological maps.

1. *Drift implements of the Paleolithic period.* That these occur most frequently on the fork between the junction of two rivers has already been pointed out by Sir John Evans. They will also be found to occur, I believe, wherever the river which deposited the gravel in which they are found passes from the chalk into Tertiary country, and usually on the "chalk side" of the boundary.

2. *Neolithic implements.* Gravel islands in the marsh of a river valley and gravel promontories or banks by the side of a river (especially in Tertiary

[2] O. G. S. Crawford: The Distribution of Early Bronze Age Settlements in Britain, *Geogr. Journ.*, Vol. 40, 1912, pp. 184–203 and 304–317; reference on p. 196.

country) will be found very prolific in "flint fields." Generally speaking, the combination required is inaccessibility and ease of defence against man and wild animals, with a handy and abundant water supply.

3. *Bronze implements.* Wherever a navigable river or an estuary impinges *directly* upon the bare chalk, with no intervening strip of alluvial marsh, there I confidently expect a small dense cluster of find-spots on the map. Similar clusters are to be expected wherever the shores of such navigable rivers and estuaries are formed by gravel or other hard ground. Places of both kinds are abundant on both shores of the Thames estuary and occur also near the mouth of the Medway, the Cambridgeshire Ouse, and the Humber. Experience already shows that the majority of hoards occur near the seacoast; the probable reasons for this have been given above.

4. *Earthworks.* It is natural to suppose that people who lived within easy access of the sea or near the mouth of a navigable estuary would become the middlemen of trade between the interior and foreign ports. Their culture would contain a vigorous element of industrialism. They would be richer in objects made of imported materials than the agricultural and pastoral inhabitants of the hinterland. Their society would be urban rather than rural—I use the words in a half metaphorical sense only. Consequently those prehistoric camps and village sites which were thus favorably situated will better repay excavation than would those in remoter regions.[3] A site with geographical nodality will contain more remains; and it is probable on a priori grounds that amongst these may occur many exotic types introduced from abroad. Such types will prove invaluable both for purposes of chronology and for tracing the origin of a given culture. Another good reason for selecting coastal sites is that here we should expect to find the earliest settlements of an invading race, and consequently here will be found relics of the older culture associated with relics of the new incoming people. This again will be of great chronological value.

[3] If I were asked to give a few instances of places that would best repay excavation I should select (taking examples only from a region which I know) Bindon Hill above Lulworth Cove in Dorset; Buckland Rings and Ampress Hole near Lymington, Hants; Chilworth Ring and the camp on Toothill near Southampton; Tourner Bury Camp on Hayling Island; and perhaps one or two of the camps on the South Downs of Sussex.

SOME ERRONEOUS IDEAS OF ARCTIC GEOGRAPHY

By VILHJALMUR STEFANSSON

TRADITIONAL IDEAS OF THE POLAR REGIONS

"The Polar Regions" is in one sense a term in geography; in another sense it is even now a term in folklore, and once upon a time that aspect was far more important than it is today. We cannot study the origin of the ideas about the polar regions, for this doubtless lies in prehistoric times. Our earliest histories show us the ideas definite in form although almost wholly erroneous in content. It is probable that few people today have a clearer idea of the polar regions than did, for instance, the Romans and the Greeks. What those ideas were we shall not consider in detail, merely summing them up as a group of mental pictures of an area lying beyond the sheltering mountains of southern Europe filled with definite terrors more or less directly allied with cold and darkness. To people of subtropical lands the very idea of water in a solid state, as ice or snow, was gruesome. To those accustomed to a succession of days and nights that varied only slightly in length from season to season the thought of short days and long nights in winter was dreadful, and that of weeks or months without sunlight the depth of horror.

As civilization advanced northward the northern regions of darkness and desolation were gradually shifted farther and farther north. But the process was slow: the generally accepted idea lagged behind the acquisition of scientific facts. The "farthest north" of Pytheas was discredited by Strabo, who placed the boundary of the habitable world just north of Britain. And of the Roman conception of the possible northward extension of civilization we have a well-known presentation in the gloomy picture of Germany drawn by Tacitus. When the heritage of classical learning passed to the Arab scholars of the Middle Ages, they readily adopted the idea of the dark and frozen north. It was still the general belief of the Mediterranean peoples. In the thirteenth century we find Robertus Anglicus protesting in Montpellier against the geographers who ascribe to England "an uninhabitable climate."[1]

Even today parts of Norway that are in reality no colder at Christmas time than Wisconsin or Massachusetts, are likely to be pictured by our university graduates as the very outposts of desolation. This is not directly through a misunderstanding of the facts of geography and meteorology but is rather a survival, in spite of correctly apprehended scientific principles, of ancient inherited opinions about the terrors of the Frozen North.

[1] Pierre Duhem: Le système du monde, 5 vols., Paris, 1913–17; reference in Vol. 3, p. 292.

Present-Day Misconceptions of the Arctic

Today the average intelligent person who is not a geographer or a meteorologist is likely to have the following ideas about the Arctic:

1. In general, it is dreadfully cold there at all times of the year; in particular, the minimum temperatures of winter are everywhere lower than they are anywhere in lands occupied by an agricultural population. In summer the greatest heat is not sufficient to make the days comfortably warm.

2. The Arctic lands are nearly everywhere devoid of vegetation. If there is any vegetation, it is mosses and lichens. A few people who are not geographers have heard that there are flowers in the polar regions, some even know that there are carpets of flowers; but this idea is prevented from becoming very enlightening by the assumption that these are all "lowly," "hardy," or "stunted" plants.

3. The Arctic is, generally speaking, devoid of animal life. In some places there are polar bears and seals, but neither of these animals nor any other is found in the water or on the ice when you get into "the remote polar regions" at great distances from land.

4. A certain mystical idea about the polar regions is responsible for a group of notions as follows: (*a*) that there is a peculiar deathlike stillness at most or all times; (*b*) that the polar night has a dreadfully depressing effect on the human spirit, but that (*c*) there is a certain fascination about the North which either in spite of its terrors or even because of them entices men of a peculiarly heroic mold into these dreadful regions, there to suffer and if need be to die in the cause of science.

We have perhaps not made this picture complete, but, so far as we have drawn it, it will be found substantially correct.

Noises of the So-Called "Silent North"

A curious instance of how an inherited idea can fail to be corrected through repeated observation is found in "the eternal silence" of the North. It seems likely to me that had Sir Clements Markham lived to see the publication of his last book, it would not have appeared as it did under the title, "The Lands of Silence." Still, it is significant that a book under that title should have been published in 1921 after centuries of polar exploration and as a summary of what is known about the Far North and Far South.

We know from the fact that Sir Clements Markham had himself been in the North and also from his own writings that he was familiar with the great variety of summer animal life. A hundred species and more of birds nest largely or almost entirely north of the arctic circle. There are millions of cackling geese and squawking ducks and tens of thousands of cranes and swans and loons. Except for the noise made by our machinery rather than by ourselves, and except for possibly one or two beasts of the tropics, there is nothing in all creation more noisy than the loon; and no one who has ever

heard their ghoulish shrieks and their maniacal laughter can think of any place infested with them as being noiseless. But in the North we have, in addition to them and in addition to the birds mentioned, more than a hundred varieties of other birds, each making its own peculiar noise. And then there are the insects. The buzz of the mosquito cannot be said to be particularly loud, but it certainly is a noise that attracts the attention of anyone who happens to be about.

These are the noises of the summer, and there are also the whistle of the spermophile, the sharp bark of the fox, and the long howl of the wolf. In the winter the birds are gone with their noise except for the unobtrusive cackle of the ptarmigan and the occasional croak of a raven. Some owls also are there, but they are never noisy. The foxes bark occasionally, as they do in summer, and through the starlit night there resounds afar the howl of the wolf (wolves are found in most of the Arctic lands) either singly or in chorus. But even were they and all other animals absent, the winter would be by no means silent. If you are inland, about the only loud noises are the whistle of the wind and the resonant cracking of the ground when it splits and splits again under the influence of expansion and contraction with changing temperature. But few explorers have spent their winters inland; rather have they been on the coast lines or in some cases out at sea.

The book dealing with polar regions that was published in England immediately preceding Markham's "Lands of Silence" was Shackleton's "South," from which we quote:[2]

> *July 25.* Very heavy pressure about the ship. During the early hours a large field on the port quarter came charging up, and on meeting our floe tossed up a ridge from ten to fifteen feet high. The blocks of ice as they broke off crumbled and piled over each other to the accompaniment of a thunderous roar. . . .
>
> *August 4.* For nine days we have had southerly winds, and the last four we have experienced howling blizzards. I am sick of the sound of the infernal wind. Din! Din! Din! and darkness. . . .

Of similar import is a quotation from my own book, "The Friendly Arctic":

> Two characteristic noises of southern lands are absent. There is not the rustle of leaves nor the roar of traffic. Nor is there the beating of waves upon a shore except in summer. But none of these sounds are heard upon the more southerly prairies. The treeless plains of Dakota when I was a boy were far more silent than ever the Arctic has been in my experience . . . near the sea at least there is, not always but on occasion, a continuous and to those in exposed situations a terrifying noise. When the ice is being piled against a polar coast there is a high-pitched screeching as one cake slides over the other, like the thousand-times magnified creaking of a rusty hinge. There is the crashing when cakes as big as a church wall, after being tilted on edge, finally pass beyond their equilibrium and topple down upon the ice; and when extensive floes, perhaps six or more feet in thickness, gradually bend under the resistless pressure of the pack until they buckle up and snap, there is a groaning as of supergiants in torment and a booming which at a distance of a mile or two sounds like a cannonade.[3]

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[2] Sir Ernest Shackleton: South, New York, 1920, p. 325.

[3] Vilhjalmur Stefansson: The Friendly Arctic: The Story of Five Years in Polar Regions, New York, 1921, p. 19.

Summer Heat in the "Frigid" Zone

That the persistence of the idea that the Arctic regions are everywhere extremely cold at all times of year is not due to any misapprehension of geographic or meteorological laws, is shown by the fact that every textbook on geography lays down the principles from which we could deduce the fact that many parts of the polar regions cannot be as cold as certain other inhabited and "civilized" parts of the northern hemisphere and that the Arctic summer in certain places must be extremely hot. The weather bureaus of all northerly countries furnish facts to bear out these geographic principles. Yet most persons remain oblivious to them.

Psychologically there is another aspect to this case. The mind has a passion for simplicity. From the economic point of view there is still another angle. We are in need of every labor-saving device. To say that the tropics are always hot, the "temperate" regions neither hot nor cold, and the polar regions always cold, satisfies the mind's craving for simplicity and saves the time of the teacher, who gets an idea into the minds of his pupils with very little effort. The only trouble is that the idea is not correct—for any of the zones. The error of this simplified idea regarding the two former zones has been well put by Mark Jefferson, "What a suggestion of burning heat has the phrase 'torrid zone' and how unwarranted! And how pleasing is the name 'temperate' applied to our own zone! . . . so intemperate in fact that the only sound description of it that applies at all times is that every season is exceptional."[4]

The textbooks tell us that the amount of solar heat received at any point on the earth's surface depends on the angle at which the sun's rays fall and the length of day and, furthermore, that the rapid increase of length of day toward the pole during summer more than compensates for the decreased angle at which the sun's rays strike the earth. Hence at midsummer more heat per square mile is received within the polar regions than at the equator.[5]

This comes into flat conflict with all our inherited views as to the nature of the polar regions, although it explains satisfactorily such figures as those given by the United States Weather Bureau for the summer temperature of Fort Yukon, Alaska, four miles north of the arctic circle, where, according to the Bureau, a temperature of 100° F. in the shade was recorded in June, 1915. Nor are high temperatures unusual. Dr. Cleveland Abbe gives 90° as the summer maximum in the Yukon valley, and, while he questions certain extremely high temperatures (112° or over) that have been reported, he says "That it grows very hot in this province [Alaskan interior] no one may deny."[6] The average temperature of the warmest month at Fort

[4] Mark Jefferson: The Real Temperatures Throughout North and South America, *Geogr. Rev.*, Vol. 6, 1918 pp. 240–267; reference on p. 240.

[5] This refers to values at the upper limit of the earth's atmosphere; but, even allowing for the loss of heat in transmission through the atmosphere, the ratio is high—according to Angot, 494 for the North Pole to 517 for the equator at the summer solstice.

[6] Cleveland Abbe, Jr.: Climate, in "The Geography and Geology of Alaska," by A. H. Brooks, *U. S. Geol. Survey Professional Paper No. 45*, 1906, pp. 133–200; reference on p. 155.

Macpherson, 65 miles within the arctic circle, is 58° F., only 1° less than that of San Francisco (59°). The mean maximum is 80°.

Great Variety of Temperature Conditions in the Arctic

But it is not conservatism alone and the volume of inherited misinformation that have enabled the idea to prevail that the North is always cold. Different parts of the Arctic have very different temperatures. There are certain parts which never become very warm in summer, and, as it happens, some of the most widely known regions are included in them because they have been convenient to traders and travelers and have been, largely through what might be called accidental reasons, the base stations of many well-known polar expeditions.

Take, for instance, Greenland with its historical connections with Europe and its present-day interest as a Danish colony. The island is a mass of high mountains which store up "cold" in the form of the well-known ice cap and locally refrigerate the air so that there are only a few places in Greenland where it ever gets uncomfortably warm in summer.[7]

Another storehouse of cold is the polar ocean which saves up enough chill from the long months of winter to neutralize locally a good deal of the summer heat. North of the arctic circle it is only where you get far away from ice-covered mountains and far away from the ocean, in such places as the northern plains of North America or Asia, that you get the intense summer heat which no one expects who holds the historic view about the Arctic but which everyone expects who understands the principles of climatology.

An Instance of the Retarding Influence of Tradition in the Development of Our Prairies

The lands that are the seat of our recent high civilization are mainly forest-covered except where the forests have been cleared away. Our people are accustomed to the idea that in order to be desirable a land must be forested. This erroneous view kept back the development of the frontiers of the United States, even as far south as Illinois, until the comparatively infertile lands around had been colonized. Only about half the history of the United States as a nation has passed since people came to realize that a land may be desirable though it be treeless. It was even more recently that our mid-western farmers saw that the absence of trees is an advantage, enabling them to cultivate at little expense lands more productive on the average than the fields reclaimed by decades of labor from originally forest-clad areas, such as those of Massachusetts or Wisconsin.

In going west from the Atlantic seaboard, the colonists did not expect to find undesirable land and were surprised and grieved when the prairie lay before them. Those who have gone north from either Europe or America,

[7] According to Hann Angmagsalik (65° 37′ N.) has a mean July temperature of 43° and an extreme temperature of 66°.

prepared to arrive at a region of desolation, found only the desolation they expected when the northern prairies lay before them, and wherever they went they filled their narratives with such adjectives as "barren" and "desolate." But, although they perhaps intended to indicate by those adjectives little beyond the mere absence of trees, they have conveyed a gloomier meaning to the stay-at-homes who read the books.

Illustrations of Tradition in Current Descriptions of Alaska

An added reason why we find it so difficult to get correct ideas about the North is that even the writers who are trying to explain to us the friendliness and fruitfulness of the Arctic are handicapped in doing so by the molds in which their childhood thought has been cast. A good example of that is a recent article in the *Review of Reviews*. This is a magazine of the higher type. Furthermore, the author of the article evidently intends to be specifically truthful. The whole tenor of what he writes contradicts his opening sentence, which is as follows: "A new chapter in the story of the international search for oil is now being unfolded in the *frozen wilderness of the far North*."[8] By the words "the frozen wilderness of the far North," he obviously does not mean to convey the idea that the country is particularly frozen. To him this is merely a formula to describe the North and does not mean that the North is frozen any more than calling Michigan the "Wolverine State" implies that the most outstanding feature of that state is the omnipresence of wolverines. We see this clearly when we follow the article on towards its end, where we find the following: "The Imperial Oil drillers were furnished with vegetable seeds when they went north and requested to observe closely the results of their planting. They found that peas planted early in June were ripe on July 23. By the end of July potatoes were ready to eat and the grass was three feet high. The soil is a rich black loam. Some day this country may serve as a great agricultural district."[9] This, then, is the very district to which he refers as the "frozen wilderness of the far North."

Another good example is "A Cheechako in Alaska and Yukon," by Charlotte Cameron. Mrs. Cameron also intends to be truthful, and scattered throughout her book are rapturous exclamations over the marvelous flowers and fruits and vegetables which she found growing nearly everywhere she went in Alaska. I have checked up the route by which she traveled and have found that it must have been seldom that she came near enough to any of the high mountains of Alaska to see a snow-capped peak. She then means nothing beyond the use of what to her is a formula or a name for the North when she says in the "Afterthoughts" to her book:

> Was this journey of 20,000 miles really worth while? The hardships, the inconveniences, the rebuffs, were they worth it all?

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[8] J. W. Smallwood: Oil in the Frozen North, *Amer. Rev. of Reviews*, Vol. 63, 1921, pp. 639–644; reference on p. 639.

[9] *Ibid.*, p. 643.

> Of a surety! This long, long jaunt *to the Arctic snows* has brought me face to face with a race of men and women whom one is proud to own as kin—the pioneers, the men who blaze the trail, the men who, God willing, will point the way to that coming race of pioneers who will set out to conquer *these ice-locked vastnesses*.[10]

Of course, she or anyone can defend the description of Alaska as "ice-locked" by pointing out that there are some glaciers, especially near the southeastern corner of the territory, and that several mountains have snow caps. Still, no one will seriously maintain that the presence of glaciers around Sitka or Juneau is reason for calling Alaska a land of ice-locked vastnesses. The reason is historical. We are merely making fair acknowledgment by our vocabulary to the ancient southern civilizations from which our ideas have descended to us.

The experience of others confirms this. F. A. McDiarmid, describing the Yukon, finds it necessary to combat the old conceptions.[11] He says:

> For countless ages all peoples have looked upon the north as a wild and barren land, the home of the iceberg and the storm. In the past few years it has been given to a favored few to learn that the Yukon is a land of beauty, of sunny days and clear skies. . . .
>
> The enchanting beauty of the wide-spreading Yukon valley—its glorious sunshine and its wealth of vegetation and fruit and flowers—comes as a great surprise to one who beholds it for the first time; and often causes the exclamation "This cannot be the north." Indeed, it is not the north land of which we have read and thought perhaps to see.

Other Factors Helping to Preserve the Tradition of the North

A set of reasons for the persistence of erroneous opinions about the North centers around the fact that many northern travelers have found it advantageous, for one reason or another, to perpetuate the idea of a land of desolation. Take, for instance, missionaries and explorers.

Many travelers are hostile in their attitude towards missionaries, saying that they do far more harm than good in such places as China and Turkey, the interior of Africa, and the northern coast of Canada. I am not one of these. My opinion is that it would be a good thing for the Eskimos if they could be protected from our "civilization" as a whole. But if our civilization goes to them, as it is bound to do, I would be the last to say that the missionaries should not go wherever the trader and whaler and prospector go. I think the missionaries help more than any other class of persons to temper to the shorn lamb the bitter wind of our civilization.

The missionaries are doing important work, or at least a work which they think is important. To carry on that work with full efficiency they must have a great deal of money. They have found out by experience, and the missionary organizations here have found out, that there is nothing that opens our purses so readily as the belief that these devoted people have been undergoing great hardships in the Far North for the glory of the Kingdom. Accordingly, it is only exceptional missionaries who take pains to

[10] Charlotte Cameron: A Cheechako in Alaska and Yukon, London, 1920, p. 292.

[11] F. A. McDiarmid: Determination of the 141st Meridian, *The Journ. Royal Astronomical Soc. of Canada*, Vol. 2, 1908, pp. 84–95; reference on pp. 84 and 86.

explain what easy and pleasant times they have in their remote fields of work.

When lecturing recently in Indianapolis I was presented to the audience by a man who had written on certain aspects of Canadian and Arctic exploration. In his introduction he assured me that whatever I might say in my lecture about the pleasant aspects of polar regions and the ease with which one could live there, he for one would never believe me and my audience would not. That is the beauty of being a polar explorer. You can go far away and do things that are easy to do, come back and say the country is friendly and the work pleasant, and still get credit for being a hero who must necessarily have gone through terrifying adventures in a region of utter desolation! Furthermore, southerners do have real hardships in the North—real to them, at least—and when graphically related the hardships are admirably suited to keeping firm in our minds our inherited views of the dreaded polar regions.

Stages in the Development of Arctic Exploration

We get a different idea, however, when we read the history of Arctic exploration during the last three hundred years and trace the gradual emancipation from its terrors. At first the travelers were in such dread of the northern winter that they made only summer forays in ships, returning home in the autumn. In the second stage of Arctic exploration they did pass the winter in the North, but practically in hibernation. It was a sort of trench warfare against the cold. They dug themselves in at the beginning of fall and managed to endure the tedium of winter through various devices, such as publishing a newspaper or the teaching of school where the officers were the masters and the sailors the pupils or various other occupations designed to kill time. In the spring they came out of their trenches in more or less trepidation and did what exploring was possible by their primitive methods during the spring and summer. As late as 1878 Sir George Nares declared that any polar explorer should be censured for cruelty who required his men to begin the work of exploration before April.

But long before the time of Nares, such pioneers as McClintock had begun to emancipate themselves from the imagined terrors of the Arctic winter. It was considered a great achievement, and was so in a certain sense, when they began to carry on sledge exploration under temperatures about the same as those at which children ordinarily go to school in winter in Manitoba and Dakota.

Explorer after explorer made advances, and one by one the imagined difficulties of the North were conquered until finally, in the time of Peary, only one or two obstacles remained serious. He had emancipated himself so completely from the fear of the winter that he laid it down as a principle that all important exploratory sledge work should be done in winter and that the journeys ought to be over before the snow began to thaw appreciably

in spring. He had devised a transportation system which we still consider the best for those parts. The two ideas that remained unconquered were that the polar sea is unnavigable (it really still is except that it is everywhere sailable by submarines) and that the polar ocean is devoid of food or fuel resources, making it necessary to carry large quantities of both. Peary himself, in his journey of four hundred miles from Cape Columbia to the North Pole, used about ten tons of food and fuel, all of which was exhausted before the journey was over.

The idea that the polar regions are devoid of animal life has been the most stubborn of the misconceptions and now remains the only one of our inherited views that is held by many explorers and many geographers. The pristine polar regions now survive only in the minds of the laity.

Erroneous Beliefs Regarding Animal Life in the Arctic

When the pioneers came to the northern prairies, they were repelled by what was to them a great desolation. Sailors of southern seas were equally repelled by the ice-covered northern ocean. It was the theory of the landsman that whatever birds or animals might be in the North in summer would certainly move south in winter. Equally, the sailors believed that the whales and seals and fishes found on the margin of the ice would go south in the fall (which is really the case with the whale and the walrus) or would remain at the edge of the ice. It was thought that at no time of year would there be any considerable amount of animal life found in the sea beneath the fairly permanent ice covering of especially that part of the polar ocean which lies around the pole of inaccessibility—the center of the icy area, a point lying about four hundred miles from the North Pole a few degrees east of the meridian of Bering Strait.[12]

It is astounding how firm a hold these theories had on the early explorers. His whole record shows that Sir Edward Parry was about as truthful a man as ever lived. Honest as he was, he was unable to distinguish between theories which he held as unassailable and facts which he had actually observed, and so he tells us explicitly that the caribou and ovibos (musk oxen) of Melville Island leave that island in the fall and go south, returning to it in the spring.[13] We now know that neither the caribou nor the ovibos leave the island and go south. The ovibos stay in the island at all times, while the caribou do travel east and west at various times of year (not particularly in autumn), going from Melville west to Prince Patrick and east to Bathurst Island. There are some also that go north and south between Melville Island and the islands to the north of that. This may happen at any time of year when the ice is sufficiently stable. There is no

[12] Vilhjalmur Stefansson: The Region of Maximum Inaccessibility in the Arctic, *Geogr. Rev.*, Vol. 10, 1920, pp. 167–172.

[13] "They arrived in Melville Island in the middle of May, crossing the ice from the southward, and quitted it on their return towards the end of September" (A Supplement to The Appendix of Captain Parry's Voyage for the Discovery of a North-West Passage, In The Years 1819–20, London, 1824, p. clxxxix).

southward migration from Borden Island to Melville Island in the fall nor any northward migration in the spring, but merely an erratic movement between. Furthermore, this fact has no bearing on Parry's statement, which was to the effect that the animals moved south from Melville Island and came north to it in the spring, a thing that has never been observed and has doubtless never occurred in the case of ovibos and seldom or never in the case of caribou.

When so reliable a man as Parry could make a definite but entirely unfounded statement about the absence of land animals from Melville Island in winter, it does not seem particularly strange that other equally honest explorers, confusing accepted theory with observed fact, make equally definite statements to the effect that animal life is absent from the ocean to the north of Siberia or Alaska or Greenland.

To begin with, explorers such as Wrangel or Nansen or Peary who traveled over the ice on the polar ocean had inherited from their ancestors the view that these were regions devoid of animal life. Quite as important is the fact that they came to the shores of the polar sea with the idea, which is held nearly universally, that primitive people, such as the Eskimos, are well-nigh infallible in their knowledge of the habits of the animals they hunt. They therefore took as fact what the Eskimos told them about seals being found only near land, assuming that these seal-hunting aborigines must know. Such an assumption should not be made. The Irish have been cultivating potatoes now for centuries, and still an Irish farmer will tell you things about the nature of the potato which you classify as simple superstition. Hundreds of generations of sailors have spent their lives on the sea and have discovered that the moon controls the weather, which it does not, and have failed to discover that the moon controls the tides, which it does. These things being so, need we suppose the Eskimos are infallible when they tell us about the habits of seals?

Native Knowledge Not Infallible

As has been said, the explorers appear to have come to the North with the idea that in this field the Eskimos were infallible. The Eskimos told the explorers that seals are found only near land, and this was taken not as the expression of a view but as the statement of a fact. When, at latitude 86° N., Peary eventually saw a seal in an open lead,[14] this struck him and his Eskimo companions as remarkable (as he told me in conversation) and requiring special explanation.

The explorers, then, knew the absence of seals from the polar ocean far from land (*a*) through their inherited views, (*b*) through information from the Eskimos, (*c*) because they never saw them, and (*d*) because of the absence of polar bears which live on seals. It seems at first a reasonable assumption that if one animal's food is known to consist practically exclusively of another

[14] R. E. Peary: The North Pole, New York, 1910, p. 250.

animal, then you would inevitably find the predatory animal wherever the food animal is abundant. This logic has the flaw that a beast of prey may succeed remarkably well under one condition and fail entirely under another. A well-known example is the snowy owl which lives on mice. In summer the owls prosper everywhere in the polar regions because at that time the mice can be seen running around on top of the ground. In winter the mice are still in the northern lands just where they were in summer but they are in their frozen holes or going around, mole-fashion and invisible to the owls, under the snow. It seems clear that owls do not suffer from the cold of the northern winter and that the only thing which drives them south in the fall is the coming of the snow, a condition that protects the mice.

I am one of those who admire the cunning and prowess of the polar bear and believe that this animal has not as yet been given full credit by the animal psychologists for its comparative rank in intelligence. However, I do not consider it a piece of extreme vanity to suppose that I have more brains than a polar bear, that I might be able to get seals in a place where bears fail utterly, and might prosper by hunting in a place where no bear could live.

In this article I cannot go into the details of seal hunting as practiced by us out on that ocean which once was supposed to be devoid of seals. There is no novelty in the method we used. The only novelty is that we applied it in a region in which neither Eskimos nor explorers had considered applying it because of their inherited views to the effect that the seals were absent, and because they had inferred the absence of the seal from the absence of bears and bear tracks. With a party from my expedition I traveled for two years in a region where we never saw a polar bear track, and still while traveling we lived mainly on seals which we were able to get from under the ice, where they would have been safe from the utmost ingenuity of polar bears, even had the bears been there to look for them.[15]

Conservatism Again a Hindrance to Discovery

The man in the street has ideas of the North that are his because the recent advances of science have not been able to change the current of popular thought as it applies to the north polar regions. The scientists themselves, being victims of their daily association with the average man and of the very vocabularies that have been built up under the influence of our old ideas about the North, have found it difficult to apply consistently to the deduction of correct views about the remote North their scientific principles evolved in southern latitudes. Had there never been a Mosaic cosmogony, with its six thousand years spanning all of human development, those might have been considered the most conservative geologists and anthropologists who made the longest estimates of the period that man as man has

[15] For methods of seal hunting, see Vilhjalmur Stefansson: The Friendly Arctic, pp. 171–172 and 301–310; *idem*, "Living Off the Country" as a Method of Arctic Exploration, *Geogr. Rev.*, Vol. 7, 1919, pp. 291–310.

existed upon the earth, for archeology shows that the bodily changes in man during the last seven thousand years have been slight, some say negligible. But it has been a fact in our day that those have been called conservative who have assumed or deduced the shortest possible period of man's history on the earth. They have esteemed it a sort of merit to make their conclusions conform to a cosmogony which, as scientists, they had entirely discarded.

There seems to be at present a similar tendency among authorities on the polar regions. Although the various sciences predispose us to make favorable conclusions about animal life in the North, we are still considered conservative in so far as we make our judgments conform, not to the principles of the sciences that apply, but to the views inherited from a superstitious ancestry. It has always been considered probable that great aggregations of animals might be found in the tropics or in the temperate zone. No serious doubts have, therefore, been cast upon estimates made in Africa or in the middle of North America about vast herds of grazing animals, whether eland or bison. I do not recall that I have ever heard questioned even the most extravagant estimates of the size of buffalo herds. These estimates, however, do not rest upon any other sort of evidence than that which goes to show that caribou move in the Arctic and sub-Arctic regions in herds equally large—say a million animals. But so strong in the public mind is the presumption for the barrenness of the North that the very men who have seen the herds which they think contain a million, will admit their real estimates to you only in conversation and will print instead of their real views statements more "conservative."

Similarly the oceanographers who have found out that animal life abounds at the margin of the ice make very guarded statements as to the probability of its extending under the ice. One by one we have already discarded nearly all of our former beliefs about the North. If in the case of any man we find nine statements of his to be lies, we incline to assume that the tenth is a lie also. In the case of the North, however, when we find our ideas one after another to be wrong, we still continue to act on the principle that the remaining ideas are probably true and that they must not be canceled except through overwhelming evidence.

Animal Life Proved Abundant in Parts of the Polar Ocean

In my reasoning about the polar regions and in my work based on that reasoning I have treated the still-accepted views about the North as I would the still-undisproved statements of a man whom I have found uniformly unreliable. I have traveled in the particular regions which Sir Clements Markham selected to point out as devoid of animal life,[16] and there I found animal life particularly abundant. No one before our time has tried systematically to find animal life in the regions previously supposed to contain ittle or none, but we who have tried have so far succeeded everywhere.

[16] Sir Clements Markham: Life of Admiral Sir Leopold McClintock, London, 1909, p. 172.

Should we then be intimidated into "conservative" adherence to old beliefs and assume that we have happened upon one favorable region after another and that somewhere else in the polar ocean there must exist at least a little remnant of the desolate polar regions that were once so extensive? Or should we say that since the applicable sciences know no principle according to which the rest of the polar ocean should be any more "devoid of animal life" than the parts already shown to be abundantly supplied, the time has come at last to follow science and observation and to place the burden of proof upon anyone who desires to maintain that there is somewhere a large part of the polar area that conforms to ancient views?

As shown in my recent book "The Friendly Arctic"[17] and as previously brought out in my article "The Region of Maximum Inaccessibility in the Arctic," the area in the Arctic covered with so much ice that it has till now remained unnavigated is not symmetrical, with the North Pole for a center, as seems to have been commonly assumed by those who supposed that the geographic North Pole was one of the places devoid of animal life. The real center of the icy area lies in the direction towards Alaska, at about latitude 83° 50′ N., or 400 statute miles from the North Pole. If the iciness of the ocean is the reason why animal life is assumed to be absent, then the assumed area of desolation should lie roughly in a circle which has the "pole of inaccessibility" rather than the North Pole for a center. If we reckon from that center, we have already found seals so near the pole of inaccessibility that the North Pole is no farther from it. There is, therefore, the same presumption for finding seals at the North Pole that there is for finding them where we have actually found them.

Arctic "Deserts" Not Large

As pointed out in the article to which we have just referred, we have found that certain areas of the polar ocean are better supplied with animal life than certain other areas. This merely corresponds to our knowledge of the continents and of the oceans. In any new land, in the sense in which North America was new four hundred years ago, the traveler who makes a long journey will find himself at one time in a region of more game and at another in a region of less. Similarly, the fishermen know that certain parts of the Atlantic are well supplied with cod and that in others the prospect of finding even one codfish is remote. From the point of view of animal life there are deserts on the continents and in the warmer oceans, so why should there not be similar deserts in the polar ocean? Thus far we have never found these seal-less areas very large. As we travel north we come into a district where there are less and less seals but, as we continue farther north, we come into another district where there are more and more seals. There appears, accordingly, no definite relation between the abundance of seals and latitude.

[17] Pp. 8–11.

Conclusion

It cannot be considered proved that seal life is as abundant at the North Pole as at certain places where we have traveled depending for our food month after month on seals; but it appears to me we have carried our investigations and reasoning on this subject so far that the burden of proof now rests on anyone who assumes that there is a part of the polar ocean, whether the North Pole or any other part, that is devoid of animal life or where animal life is so scarce that a skillful hunter would find it difficult to secure food and fuel for a small party of men and dogs.

THE GEOGRAPHY OF HISTORY: A REVIEW*

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The World War of 1914–1918 and the Peace Conference which followed demonstrated with a clearness previously unknown that a knowledge of geographic facts and principles is fundamental to any adequate conception of the great problems of war and peace. The relative importance of the rôle which geography plays in history had long been debated, both in this country and abroad; and important works dealing with the "geographic basis" of history had been published in our own and other languages years before the cataclysm of 1914 burst upon the world. But it was the clash of whole nations in arms which revealed the true military value of efficiently mobilized scientific knowledge, including geographic knowledge; and it was the clash of national interests at Paris which exposed at the bottom of nearly every controversy a geographic foundation. That the lesson of these facts has not been lost to the world is obvious, for the man who speaks on problems of military geography or political geography enjoys a far wider and more attentive hearing today than he did eight years ago.

To no one dealing with the relations of geography to man and his activities, will a more respectful hearing be accorded than to Jean Brunhes, the distinguished author of "La géographie humaine" and professor at the Collège de France. When he speaks in collaboration with one best known for his writings on "Géographie sociale: La mer" and "Le sol et l'état," Camille Vallaux, his words must carry added conviction. The joint work of these two authors is in reality two volumes in one. The first is a general treatise on the relations between geography and history; the second is mainly a discussion of the World War and the problems arising from it, considered from the geographic point of view. It appears that the first was largely completed in substance, if not in its present form, before 1914; while much of the second is necessarily of later origin. It will not be inappropriate, therefore, if we confine our attention to the more general first part of this important work. The present writer will attempt the by-no-means easy task of translating into a few pages the chief argument of these two eminent geographers and will then append to this digest certain comments.

Synopsis of the Work

If the distribution of towns and cities, of roads, railways, cables, and canals, and of all the other products of man's activities throughout the ages

* Jean Brunhes and Camille Vallaux: La géographie de l'histoire: Géographie de la paix et de la guerre sur terre et sur mer. ii and 716 pp.; maps, diagrs., index. Félix Alcan, Paris, 1921. 10 x 6¾ inches.

is geography, then certainly man in making history on the earth makes also geography. History, in other words, translates itself in geographic terms; and the great geographic facts of today are not the discoveries of the North Pole and the South Pole, but such events as the piercing of the Isthmus of Suez and the opening of the Panama Canal. On the other hand, geography translates itself in history. A high, flat-topped mesa, bordered by precipitous slopes and surrounded with a protecting belt of marshland, becomes the advanced bulwark of Christianity in the north of Gaul, an impregnable islet escaping the ravages of the Vandals, the refuge of the last Carolingians, a fortified city playing an important rôle in many wars. Can one doubt that the exceptional topography of Laon predestined it to figure as a stronghold from the earliest days of history? So also the unhindered exploitation of great natural lines of communication, like that of the Hudson-Mohawk depression, means rapid progress in the peaceful development of the adjoining regions; while the artificial blocking of such a route, as exemplified in Austria-Hungary's attempt to render Serbia commercially dependent on the Dual Monarchy by closing the natural pathway forming Serbia's direct outlet to the sea, can only end in one of those historical crises in which geography takes revenge against unnatural political doctrines.

Man the Chief Geographic Agent

The interrelations of geography and history, barely touched upon in the preceding paragraphs but treated at some length by Brunhes and Vallaux, lead naturally to the discussion of men as geographic agents. In modifying the surface of the earth the sixteen hundred millions of human beings continually active upon it are far more important, in the opinion of our authors, than are the physical agents of nature such as volcanoes, glaciers, and rivers. This because of the vast scope of man's activities, his remarkable adaptability to varying physical conditions, and the infinite variety and incalculable number of his acts which in their totality profoundly and ceaselessly affect land areas; and especially because, as Woeikof has accurately remarked, man has power over the *movable things* on the earth. He can control the moving waters, dam them, change them into other forms of power, lead them in canals to serve as means of transport or to irrigate his fields. Agriculture depends on his control over the surface layers of the lands, his ability to break and move them, to remove some elements and add others. Road construction, house building, mining, manufacture involve the breaking in pieces and putting together again of the movable things on the earth. It is his power over these things which makes man of interest not only to the ethnographer, the historian, the statistician, but also to the geographer who sees in him the most important of all geographic agents.

Having established that geography and history are intimately related and that in considering their inter-relations we have to deal with man as the most important geographic agent, we turn naturally to the earliest human

records as the proper beginning of a study of "the geography of history." Here we have to note that the student of prehistoric records can no longer be satisfied with an attempt to discover successive stages of ancient civilizations superposed one above the other, and thus to establish a chronology of man's development in time; he must study the extension of these civilizations over the earth's surface, as affected by differences in climate, fauna, flora, and other environmental factors, at a time when man was far more dependent upon his physical surroundings than he is today. In the same way the earliest written history, those confused records of groups of men which constitute the dawn of history, can only be understood and rendered more precise when interpreted in the light of geography. The history of Greece and of Greek art is not fully intelligible unless one studies its beginnings with a true understanding of the peculiar physical environment formed by the island-studded eastern Mediterranean and its labyrinthine coasts, where the sea rather than the land formed the highway of human movements.

Precautions Requisite in Geographic Interpretations

"Prehistory" and "protohistory" (early history) are succeeded by history proper, with its ever-increasing wealth of facts requiring analysis, classification, and interpretation. In this work the rôle of human geography is highly important. But the geographer must exercise care in making his interpretations, for, while many social facts have a geographic basis, it is equally true that many facts apparently geographic in origin depend upon wholly artificial social or psychological causes. Differences in the agriculture of two states may depend upon differences in the laws regulating the distribution of land rather than upon differences of soil, climate, or other physical factors. Care must also be taken that interpretations are not invalidated through failure to determine the statistical value of geographic facts. How many travelers judge a race by one accurately measured individual, or describe a people as hospitable after having been well received by the inhabitants of a single place! In geography it is not the exceptional fact but the usual fact, not the weight of an unusual stalk of wheat but the number of bushels produced per acre, not the rare specimen of mineral but the average run of the mine, that is of value. Finally, we must realize that what appear superficially as purely physical geographic facts, exercising a more or less fatalistic determination upon the acts of human beings, are often of significance only in relation to certain aspects of a changing human psychology. A river or a mountain is a "natural frontier" only when we have such and such economic and political conceptions of a frontier; and these conceptions change profoundly in the course of history. The "economic geography" of a given region may be greatly altered by the psychological fact of man's directing his attention to a new method of culture, as when the development of "dry farming" in parts of the western United States gave the same results as would a doubling of the local rainfall.

With the foregoing precautions in mind, the authors examine from the geographic point of view: (1) certain aspects of the distribution of agricultural products and man's progress in developing improved methods of agriculture; (2) the distribution of population over the earth and the causes of changes therein; and (3) the distribution and development of organized states (political geography). The object of this examination is to demonstrate that social history is solely determined neither by economic history nor by political history, but depends in an important measure upon geographic factors. Let us consider first the problem of population distribution.

Unequal Distribution of Population

Men are very unequally distributed over the fact of the earth, sparsely scattered here, densely concentrated elsewhere. The mere matter of numbers is one of the sovereign laws of history; for the degree of concentration of men determines the force of resistance of certain great groups—as in China; the force of expansion of others—as in Europe. The world's population has increased by fifty per cent in the last century, a prodigious rate which is unknown in previous history and which has taken place largely in the European population or populations of European extraction; whereas the other two great centers of population—China and India—have remained stationary, and intertropical Africa has actually witnessed a decrease. Were geography, in its narrower conception, the determining factor in the distribution of men, we should expect the densest populations always to be found where nature offers the most abundant and most easily procured resources for food, shelter, and commerce. As a matter of fact, vast exposures of fertile lands with favorable climate remain little occupied, while at the same time many rocky lands with scanty, infertile soil and rude climate are peopled more densely than natural conditions warrant. Furthermore, where geographic conditions have remained sensibly unaltered, we not infrequently see today a scanty population where formerly great numbers lived. Evidently no geographic condition can in itself explain the extreme inequality in the distribution of men.

Zones of Passive Concentration

If we examine the present zones of densely concentrated population we find them to be of two types: (1) zones of *passive* concentration, like China, India, Egypt, and the Sudan, "lands of water and sun," where the number of the population depends in great measure upon natural geographic conditions, and where these conditions favor not laziness, but limited and incomplete human effort; and (2) zones of *active* concentration, like parts of Europe and North America, where, natural conditions being on the whole unfavorable, the struggle for existence stimulates and invigorates men and favors their multiplication in order to provide additional means of over-

coming the difficulties which confront them. The relation of density of population to geographic conditions in a country of the first type is well illustrated by comparing three maps of India showing the rainfall, the culture of wheat, rice, and millet, and the distribution of population. These three maps correspond with an exactitude most remarkable. The term "passive concentration" is appropriate for countries like India and China, for in them the human plant thrives *in situ*, as in a favorable soil; and the population of these two countries, together accounting for almost half the people on the globe, has remained relatively stable throughout history, receiving little influx from outside and contributing little to the rest of the world. The limits of the population of India are almost as fixed as are the country's geographic limits—the Himalayas and the Indus. Nowhere have the Indians pushed outward, not even upon the ocean, which, although called Indian Ocean, has been successively Arab, Portuguese, Dutch, Franco-English, and now British, but never Indian. The expansion of the Chinese, while great when compared with the more stationary India, has been slight and slow as compared with the movements which peopled Europe and America.

Zones of Active Concentration

In the zones of active concentration we find the population increasing as a sequel to man's struggle against the sea, against the forest, against the steppe. First it was the inland seas and the marginal areas of the greater oceans that witnessed the struggle. In so far as man drew his living from marine animals, the distribution of which depends in turn upon the temperature, depth, and movement of the sea water, he was subject to geographic limitations; and the early distribution of maritime populations in the northern hemisphere is believed to have resulted mainly from the thermal contrasts of warm and cold ocean currents and from the climatic and biological phenomena to which these contrasts give rise. But it was the struggle against the hardships of the fisherman's life that developed vigor in the population and increased its fecundity. Today it is the great ocean and maritime commerce, rather than marginal seas and fishing, that are responsible for the active concentration of population in the favored zones; for maritime commerce is a more powerful factor in drawing together in cities men from all parts of the world than ever were the great industries of "the age of coal."

The forest also invites an active concentration of population by virtue of the hardships it opposes to man, and both in Europe and North America great populations now live where once spread a wilderness of trees. In the struggle to clear the land not only are man's energies effectively developed, but an abundant offspring is necessary in order to provide more hands to conquer and cultivate the soil. Hence the forest zone of severe life conditions is peopled more rapidly than the steppe, where man is content to live in com-

parative ease a pastoral and more or less nomadic existence. Today, with the ancient forests largely conquered, population begins to increase more rapidly in the regions of steppes; but only because there is now more land available in these regions, and because the proper cultivation of the soil is there more recent.

Influence of Water Supply and Coal Supply on Population

Another important factor in influencing the distribution of population is the water supply. This factor is not of consequence in the "lands of water and sun," where water, like the sunshine, is everywhere abundant. But elsewhere it determines whether the people shall be strung out along river courses, or concentrated in zones where common effort establishes a complex system of irrigation, or clustered more compactly about deep and therefore costly wells dug at the common expense, or scattered widely in little hamlets and isolated farms served by innumerable shallow and inexpensive wells. These conditions of living react upon the fecundity of the people, and hence still further upon the density of population.

The vast industries based upon the exploitation of coal in the last century have profoundly affected the distribution of men and in Europe have led to an active concentration of population in a zone adjacent to the belt of coal deposits extending along the fiftieth parallel from the Atlantic on the west to the great steppes of the east. But, contrary to the common explanation of economists, the concentration is not due simply to an influx of men from rural communities, attracted by the large salaries offered in the industries. The division between the rural population and the industrial laborers remains fairly distinct; the workmen are most often sons of workmen, for the laborers in no wise limit their offspring during the youth and maturity of industrial development. As a result the birth rate among laboring classes for a long time exceeds that of the rural population, as it formerly did in France and England, and still does in Germany. Further supplies of labor, above that furnished by the children of laborers, must for a long time be imported from a distance, for the rural population leaves the land for mine and factory very slowly and with many misgivings.

Urban Concentration and Northward Migration

Two striking phenomena of the concentration of the white population of the world are, on the one hand, the ever growing tendency for men to leave the small and middle-sized towns for the great cities and, on the other, a gradual northward movement of the centers of maximum population. In prolific Germany, where the population has risen since 1871 from 40,000,000 to 68,000,000, the figure for the rural population has remained stationary at about 25,000,000. In France and England the cities continue to increase in size while the rural districts remain stationary or actually suffer a loss. In

the United States the relative proportions of rural and urban populations change yearly in favor of the urban population. Equally true, but so gradual as to be almost imperceptible unless we consider long periods of history, is the northward migration of urban populations coincident with the shifting of economic and political power in this direction. At an early epoch we find Thebes, Memphis, Babylon, and Nineveh situated between latitudes 25° and 36° N.; later Byzantium, Carthage, Rome, Athens, Cordova, and Toledo, from 33° to 42°; and now Paris, London, Vienna, Berlin, Petrograd, and Stockholm, from 48° to 60°.

Movements Not Explained by Geographic Facts Alone

If we turn our attention from the "facts of fixation" of population, considered above, to the "facts of movement," we must first have care not to attempt to explain human movements simply on geographic grounds. A brief study convinces us that people do not, for example, move from places where the natural facilities for existence are insufficient, to places where such facilities are superior. On the contrary, one may observe dense populations continue the struggle for existence and constantly increase in numbers where neither the soil, commerce, nor the industries make true well-being possible; while other regions, marvelously endowed in natural resources and in the accumulated products of human toil, not only are sparsely populated but continue to lose numbers through an insufficient birth rate or emigration and most often through both causes at once. The true explanation for such phenomena often lies in the fields of economics or psychology rather than in that of geography. Desire to avoid that subdivision of the ancestral property which results from having many children, an exaggerated love of easy living and a dislike of heavy toil, feminine aversion to suffering and the desire to keep intact cash capital as well as land combine to lower the birth rate and thus cause depopulation of rich lands like those of Normandy. In other parts of France rich country regions are in time deserted because the lure of the city eventually draws to it some of the most active spirits, who become artists, politicians, statesmen; and the rest follow in their wake, content to perform the most menial tasks in the city rather than till the soil. Elsewhere it may be political disorders, poor distribution of lands, or social causes which incite masses of men to migrate. In still other cases the movement clearly has a geographic basis. The discovery of valuable mineral deposits, the exploitation of forests, famines due to failure of rains, overpopulation of sterile lands incapable of yielding an adequate food supply either draw people to the favored localities or expel them from the unfavored. But we hesitate to explain the invasions of the barbarians and the great migrations of Asiatic hordes from east to west, either, like Kropotkin, by the gradual desiccation of central Asia, or, like Huntington, by oscillations of wet and dry periods. The desiccation has not been sufficiently accentuated, nor have the climatic oscillations been sufficiently pronounced, to change

radically the conditions or manner of living in Asia; and so long as the manner of living may remain the same, there is no natural reason for an exodus *en masse*.

Migration Routes

If geography fails to explain many major facts in the movements of men, it at least has a special interest when we come to study the routes of those movements. Migrating masses have a tendency to avoid obstacles and to seek the natural passages opened by nature. Yet even in this part of our study we must observe caution, and note that this law is strictly true only when men are poorly equipped to contend against nature and are spread over a region lacking proper transportation routes and adequate protection for the individual.

In earlier days the main obstacles to human movements were mountain masses, deserts, forests, marshes, and the open sea. But the routes followed by migrating peoples were not merely, nor principally, the routes best calculated to avoid these obstacles. They were also of necessity the routes along which they could best *eat;* for food for such numbers could not be carried with them. Chief among these routes were the grassy steppes, usually bordering the deserts, where there was water enough for man and grass for his herds, and where the trees were not numerous enough to hinder the movement of the mass. The great migrations of early history were thus migrations of pastoral peoples and temporary farmers, who lived in tents, led their flocks with them, and lightly tilled the soil for a single season before moving on. A second type of migration route was formed by the margins of the seas. Here boats and fish replaced the herds of the steppe, and the life of the trader and fisherman differed widely from that of the pastoral nomad. Phoenicians and Greeks, following the borders of the Mediterranean; Scandinavian and German traders, warriors, and pirates, skirting the shores of north European seas—give us examples of sea-border migration. Finally the rôle of great rivers as routes of early migration, while a subordinate one, deserves mention. Today conditions are so far changed that the open sea, once the most formidable of obstacles, is become the great route of movement for masses of men.

Development of the State

Having considered mankind first in its work of stabilization and exploitation of the soil, and then in its movements from place to place, we must next turn our attention to the three fundamental problems of political geography: (1) the territorial expanse of the state, (2) lines of communication and the frontier of the state, and (3) the capital of the state.

Possession of a certain expanse of territory is a primary condition of the formation of a state. The political association is born of the necessity of collective security, and this necessity appears only when men, appropriat-

ing territory and exploiting it to meet their needs, feel that they have a common patrimony to defend. Absolute and complete nomadism prevents the formation of a state. Another primary condition is a certain minimum density of population. There must be, among the men composing the group, sufficient intercommunication for the need of common security to be felt and for the organization of that security to be possible; and this does not exist where men are too thinly scattered. There must also be, in close proximity, other groups that are enemies or rivals, or capable of becoming such, which are likewise able to form states; for only thus does the need of security against outside attack become apparent. The state *se pose en s'opposant*. Hence arises the importance of the geographic conception of "position." The Eskimos occupy permanently no territory, have not the requisite density of population, nor the contiguity of opposing groups that would enable them to form a state.

Even when the conditions requisite for the formation of a state exist, the development of the state does not always meet with the same degree of success. In some places one state after another is born, quickly rises to power, and then dies, new states always rising from their ashes. Elsewhere development of states is slow and incomplete, and the groups composing them apt to come under the influence of their more vigorous competitors. We may call these the *active* and the *passive* political regions, and a study of them in their historical development, in order to determine how far geographic conditions are responsible for their marked differences, gives highly interesting results. It shows us, for example, that no state or group of states can exist without an active struggle within the state or between states. Political societies may live in peace, in the ordinary sense of this word; but they cannot live in repose. This constant struggle changes, not merely from year to year but from day to day and even from hour to hour, the map of the world—not the map as we are able crudely to represent it but the real map which would show, if we could but draw it, the actual political and social life of human groups at any given moment of their ever-changing existence. The historical maps to which we are accustomed give an appearance of temporary stability followed by sudden and often great changes, which has little relation to the never-ceasing progressive changes taking place.

The changes just referred to involve, among other things, an obedience of most large political societies to a "law of increasing agglutination." Great states grow from small nuclei by successive incorporations of adjoining small states which have neither sufficient internal cohesive force nor sufficient expansive force to maintain their autonomy. But, while this is a general law, it is not, as Ratzel and other Germans would have us believe, a necessary and universal law. In the political geography of Ratzel one sees the fate of Belgium and Serbia fixed in advance and reads the full meaning of that author's statement that "Europe and Australia really have room enough for but one great power."

Political Significance of Lines of Communication

The second fundamental problem of the state is to assure the cohesion of the parts which constitute it, and to establish upon its periphery a permanent defense against interference from without. Of these two objects the first is realized through *lines of communication*, the second by means of a *frontier*. Lines of communication are not commonly regarded in this light, so greatly has their secondary use for economic purposes obscured their primary purpose. This is natural, for in times of peace we see water routes, roads, railways, and telegraph lines serving the free movement of men, goods, and thoughts. Only in time of war does the primary purpose of these routes become evident, and only then do we realize that their most essential characteristic is *permanent security of passage*, obtained by removing material obstacles, maintaining a proper upkeep, and furnishing adequate police protection. Security of passage throughout its parts is essential to the cohesion of the state, and state supervision of lines of communication is one of the clearest proofs of political possession of the land. The great central artery of the Persian Empire which, significantly enough, coincided for long distances with the route of the Bagdad railway, and the network of roads which bound together the component parts of the Roman Empire are familiar illustrations in which the political significance of lines of communication is clearly apparent.

Frontiers

In studying the frontiers of states we must first rid ourselves of the false notion that the frontier can be a line. Frontier zones are realities, the frontier line is only an abstraction. Every true frontier is a zone more or less completely organized for military and economic defense against the neighboring state. In this zone are concentrated the pressures and counterpressures inevitably resulting from the struggle for existence of two organized peoples. Those misguided individuals who hope to realize Utopian ideals by abolishing boundary lines between nations fail to understand that such lines are not created by statesmen to limit the freedom of peoples but represent attempts to define and locate an inescapable reality. If the line were abolished, together with its associated military posts and customhouses, the zone of pressure and counterpressure between the two peoples would remain unaffected and would soon compel the recreation of the things abolished. Where there is active tension in the frontier zone, the boundary line is apt to change with comparative frequency to meet the changing balance of forces. But if the tension is relieved, through the decadence of one of the states or its expansion in other directions, we may have a *dead frontier*, one with little tendency to change. Before the Treaty of the Pyrenees in 1659 the Franco-Spanish frontier suffered frequent changes in position; since that date and the fall of Spain from its place as a great power there has been no tension, and it has not even seemed worth while to correct the obvious blunders of the negotiators of that treaty.

The study of European frontiers shows their gradual transition from wide and little-inhabited zones between peoples, through a second stage in which the vacant zone remains on the side of the more barbarous people but is replaced by a protective wall or line of fortifications on the side of the more advanced state; then through a third stage in which there is no vacant zone but a chain of more or less detached fortified points, between which the two peoples interpenetrate each other most irregularly, with numerous enclaves of one group isolated within the other; finally reaching the fourth stage in which the more perfect internal organization of each state is reflected in a relatively simple and wholly continuous frontier between them. Such a study also convinces us that since neither rivers nor mountains serve as protective barriers to prevent the passage of armies, they do not constitute "natural frontiers." Practically there are, aside from the open sea, no natural frontiers between vigorous states.

The State Capital

Just as there can be no state without lines of communication to bind its parts together and a frontier zone to protect it from outside interference, so also there is no state without a central organ, the capital. This is the third primary necessity for the existence of a state. The capital is the thinking head of the state; hence the disaster which threatens a nation if its capital is captured in time of war. State capitals are *natural* when they are established in pre-existing cities located where natural conditions favored their development; they are *artificial* when created where no urban development had previously taken place. When a pre-existing city is chosen as a capital, it is because in addition to its other natural advantages it possesses that of a favorable geographic *position*. Paris is the type example of natural capitals. Artificial capitals depend solely upon the advantages of position, and Petrograd, whose *site* is most unfavorable but whose *position* is admirable, was the best example. The government of Lenin has abandoned the artificial capital in favor of the natural capital of Russia (Moscow), and Petrograd is now in full process of decay. A study of the capitals of the world also shows us that about half of them are located on the sea or in close connection with the sea; and that for other reasons many capitals occupy a markedly eccentric position with respect to the territory of the nation and even with respect to the distribution of its population.

Political Geography of the Future

If now we review the actual facts of political geography that we have thus far been considering and take into account those facts with which mankind will certainly have to deal in the near future, we can with some assurance predict certain aspects of the political geography of tomorrow. There is no essential geographic characteristic of the state which is not destined to

undergo profound alteration as a consequence of continued improvement in means of transport. The capitals, already overcrowded, will become more crowded still; recruiting their populations from afar, they will become ever more cosmopolitan and denationalized. Since acceleration of transport acts in effect as a reduction of distance, the size of states and the effects of size upon the cohesion of the component parts will progressively change. Such changes must in turn react upon the economic and social life of peoples.

One result of these changes will be to bring into existence in the future larger political organizations than the simple and homogeneous states which we know today. A common civilization, involving perhaps common traditions, a common mother tongue, a common religion, identical or analogous institutions, or only certain ones among these unifying forces, will lead different states to unite in a co-operative federation, either for the purpose of equalizing among themselves the conditions of existence or in order to resist successfully the growing pressure or violent attacks of other groups. The organization of these federated states will have little resemblance to the temporary alliances of the past. Such alliances have, until a very recent date, usually been concluded between two powers only. Under the growing pressure of new geographic facts an alliance between a group of powers has become more common. In the future the co-operation will be far more close, and individual relations between powers will be rare. The relations themselves will profoundly change and, instead of being directed, as in the past, largely toward securing an equilibrium of forces, will seek to achieve in addition an equilibrium in the distribution of raw materials and manufactured products destined to satisfy the needs of the peoples concerned. No nation will in the future be economically independent; and, since power rests on economic wealth, the states must gather into groups in order to combine those resources essential to great power. That these federations of states will be more permanent than the alliances of the past cannot be doubted, for they will be founded on geographic conditions far more stable than the military strength and moral elements which served as bases for the old alliances. Boundary lines will change less often, wars will become more difficult and dangerous and hence of rarer occurrence. But this gain to humanity may be more than offset by an increase in their devastating fury when they do occur.

A League of Nations Impossible

It might seem that the logical end of the coming increased co-operation among nations would be a league of nations, composed of all civilized peoples and organized to make war impossible. Such reasoning is not justified. The essential aim of a league of nations, to make a final and lasting division of the earth's surface among the peoples of the world and to maintain thenceforward all frontiers inviolate, is impossible of achievement; because a perfect equilibrium, even if it could be once established, would

not endure. The great forces of political geography would destroy it. If the league of nations tried to take account of changing forces, it would find the task too delicate and difficult. The logical end, and the one best adapted to the realities of the present and of the future, is not a universal league of nations, but groups of federated states in unstable equilibrium accommodating themselves to changes in politico-geographical conditions.

Comments

Thus far Brunhes and Vallaux. This digest of their argument is necessarily incomplete and imperfect, but it may be sufficient to indicate the wide range and compelling interest of their work. It remains to comment on certain phases of their treatment. The reader will appreciate the few maps and diagrams that illustrate the text. Nothing could be more effective than the series of diagrams (Figs. 2–5) showing graphically how improved means of transport have in effect caused France to shrink to a tiny fraction of its former size, changed Corsica to half its size and brought it within one-third its former distance from Marseilles, narrowed Dover Strait by two-thirds, and reduced the breadth of the Atlantic Ocean by more than three-fourths, bringing New York and Le Havre within 162 hours of each other instead of 734 hours as formerly. One could wish that the text were illuminated by more illustrations, for its value would thereby certainly be increased.

Two characteristics of the text leave a strong impression upon the reader. One is a certain lack of clearness, due possibly to the very wealth of material presented. To put a geographic statement in its proper setting requires, perhaps, a brief sentence touching on some related, though distinct, theme. But this sentence raises in the authors' fertile minds additional corollaries or examples, and the sentence becomes a paragraph or several paragraphs. The reader is interested but he is also diverted; and the logic of the argument is sometimes obscured. The second impression is that produced by the authors' commendable care not to overvalue or overemphasize the rôle of geography in history. The reader is repeatedly cautioned against the danger of attempting a simple geographic explanation for historical events, and emphasis is placed on the fact that much harm has resulted when over-enthusiastic geographers have sought to explain events from the geographic viewpoint alone, or to assign to geography too great a rôle in history or a rôle too simple and determinative. "The earth certainly controls human activity; but man in turn controls the earth."

It would not be fair to expect that in the subject matter of a work covering so wide a range of human interests as does "La géographie de l'histoire," the authors should escape grounds for criticism. In places the careful reader will follow the authors with doubt and misgivings, or feel that he cannot follow them at all. He may, for example, question the geographic quality of cathedrals, even though they are situated on the earth's surface, and can

be represented on maps. Similarly the geographical element in the history of the improvement of the cabbage and the diversification of its types by careful selection and cultivation may escape him, as also in the influence of religious laws and customs on what people eat. But perhaps this is, after all, a matter of definition; and if the reader accepts Brunhes' definition of human geography as explained and illustrated in his "Géographie humaine," then he cannot question the propriety of treating these things in "La géographie de l'histoire." He may still wonder, however, whether in attributing important geographic consequences to "the struggle between the warm waters and the cold waters, the blue waters and the green waters" of the ocean (pp. 150–152) the authors have not, in the first place, overlooked physical characters of the ocean, such as differences in depth, differences in oxygen content of shallow and deep waters, differences in salinity, in suspended sediment, in quantity of microscopic plants and animals, and other factors, some of which affect the observed color differences as well as does temperature, and others of which may profoundly influence, directly or indirectly, the distribution of food fishes and hence man's activities; and whether they have not, in the second place, undervalued geographic factors vastly more important than the temperature contrasts of these waters when they make of them "the essential and determining forces" in the distribution of maritime populations.

Treatment of Forests and Steppes

When the authors make a mystery of the fact that forested areas are populated more rapidly than steppes (pp. 166–190) and then seek to explain the mystery by showing that, although life on the steppe is easy and comfortable (*sic*) and that in the forest is laborious and trying, the very wealth of effort required to overcome the forest breeds energy and provokes an increase in population—we are quite unable to follow them. There is no mystery in the obvious fact that man tends to populate most rapidly those portions of a new country where rainfall is sufficiently abundant for him to grow plenty of food for his needs (such areas are apt to be forested) and avoids those areas where hard experience teaches him that the rainfall is too scanty to permit the raising of crops (such areas include the steppes). If a region of fairly abundant rainfall happens to be treeless or but scantily forested, and other conditions are favorable, man passes by the forested lands and presses painfully onward to where the conditions of life are easier, as was the case in the rapid populating of our prairie plains when their potentialities had once been realized. On the other hand, if topographic or soil conditions make life in the forested belt unusually difficult, the forest remains sparsely populated, as in much of our Appalachian region. Many Americans unwisely pressed westward beyond the line of twenty inches of rainfall into the region of the steppe but were forced back because conditions of life were there too difficult. The inhabitant of the eastern forest still

enjoys advantages in the form of game, fish, and wild fruits practically unknown to the inhabitant of the steppe; and the western pioneer of today is as noted for his vigor and energy as was ever the clearer of the eastern forest.

Treatment of Natural Frontiers

The authors' treatment of the subject of natural frontiers (pp. 354–361) is disappointing. They err in limiting the rôle of such frontiers to serving as protective barriers, with the result that their discussion is incomplete and their conclusions in part at least invalidated. Equally erroneous is their assumption that rivers and mountains have no value as military barriers, since they can be passed by determined armies (but at what a price!); and we read the surprising statement that "no European river has served efficaciously as a barrier." Surely they have not read aright the lessons of the Great War. They sometimes confound *mountains* with the line of the *watershed* in the mountains and fail to recognize that both in the recent war and in other historic struggles mountain barriers checked an invasion, even in cases where the invaders passed a short distance beyond the drainage divide. They overestimate the simplicity of the river as a basis for the demarcation of a boundary line and underestimate the difficulties resulting from shiftings of the river's course. These difficulties are real and serious, and they were so far taken into account at the Peace Conference of Paris that the location of more than one international boundary was in part determined by the necessity of avoiding the conflicts to which such changes of river courses give rise. And whether or not one agrees with Huntington's ideas as to the effects of climatic oscillations on human migrations, one will feel that Huntington's arguments are sufficiently serious to deserve a more adequate reply than contrary assertions unsupported by arguments or facts (pp. 227–228).

Impossibility of National Isolation

It would be wrong to overestimate the importance of these shortcomings. After all, they are matters which in no wise affect the validity of the large lessons the authors seek to teach, nor do they materially detract from the very high value of the treatise. They merely show that "La géographie de l'histoire" should be read carefully and intelligently. The important fact remains that it should be read, not only by geographers, but by every one who seeks light on the troubled problems confronting the world today, whose solution will make the history of tomorrow. All such readers will find Brunhes and Vallaux's work not only of absorbing interest but also of real service in clarifying their ideas on a variety of political and economic questions. And it is in no spirit of levity that we would commend certain pages of this valuable book to those members of the United States Senate who think the future weal of this country depends upon its adhesion to a policy of "splendid isolation:" "It is not only an uninterrupted contiguity [of states] which is

thus established, it is also what we may call an uninterrupted *interdependence*, the threads of which will not loosen in the future; on the contrary they will never cease to grow tighter. Henceforth no state, large or small, can live within frontiers hermetically sealed. . . . Tomorrow there will be no isolation, splendid or otherwise, for any state, no matter how powerful or feeble it may be. The earth, grown too small, will no longer permit anyone to live unto himself. There will be, in the relations between states, a certain imperious obligatory compulsion, either toward co-operation or toward hostility, such as has not hitherto existed. . . . Tomorrow individual relations between states, either in peace or in war, will practically cease to exist. . . . In order to form an organism as strong and rich as possible, the states must co-operate in groups to the end that they may include within their federated territories the whole gamut of natural resources and manufactured products demanded by the growing complexity of social life. It is only through this interdependence, voluntarily established among some of their number, that peoples can escape the universal dependence, and consequently the inevitable subjection, that will be the fate of the isolated" (pp. 423–426).

GEOGRAPHICAL RECORD

AMERICAN GEOGRAPHICAL SOCIETY

Meetings of December, January, February, and March and Elections to Fellowship. Regular monthly meetings of the American Geographical Society were held at the Engineering Societies' Building, 29 West Thirty-ninth Street, on December 20, 1921, January 24, February 21, and March 21. At the December meeting Mr. William Beebe gave an admirably illustrated lecture on "A Naturalist in British Guiana Jungles," describing the work of the Tropical Research Station of the New York Zoological Society at Kartabo, British Guiana, of which he is director. At the January meeting, after presentation of the annual reports, of the Society (printed below), a timely address on the "Political Geography of the Pacific" was given by Professor Albert Bushnell Hart. At the February meeting Professor A. V. Williams Jackson spoke on "Travels in Persia." Professor Jackson, who has made three research expeditions to Persia, recently revisited that country as a member of the American Committee for Persian Relief. On January 3 under the joint auspices of the American Geographical Society, the Oriental Club of New York, and the Columbia University Institute of Arts and Sciences a lecture was given at the Horace Mann Auditorium by Mr. Henry Lee Shuttleworth, District Officer of the Punjab, on "The People and Scenery of the Western Himalayan Countries between Simla and Kashmir." A selection of photographs and other illustrative material from Mr. Shuttleworth's collections was on exhibition at the Society's building from January 3 to January 5. At the meeting of March 21 Mr. Fred Payne Clatworthy gave a lecture on "Colorado and the Southwest in Natural Colors," illustrated by autochrome slides.

At the last meeting for the season, to be held on April 25, the Society will be honored by Mr. John W. Davis, late Ambassador to Great Britain who will speak on "The Unguarded Boundary."

At the December, January, and February meetings, President Greenough presiding, there were presented with the approval of the Council the names of 96 candidates who were duly elected as Fellows of the Society.

Annual Reports of the Society. At the annual meeting of the American Geographical Society, held on January 24 at the Engineering Societies' Building, 29 West Thirty-ninth Street, the annual reports of the Council, of the Treasurer, and of the Special Committee were read as follows:

Report of the Council

To the Fellows of the Society:

The record of the past year has been marked by activity and progress in the established purposes of the Society. The primary effort is directed to the production and publication of scientific and original geographical papers which it is believed will afford not only interest and information to the Fellows of the Society, but will add very substantially to permanent geographic knowledge.

As a necessary corollary to such endeavors no effort is spared to maintain the library as an efficient instrument for scholars and writers. The progress during the past year in cataloguing and in additions exceeds that of any similar period. Additions during the year comprise 1,401 books, 720 pamphlets, 6,700 periodicals, 3,182 maps, 77 atlases. The collection now numbers 59,331 volumes of books and pamphlets and 53,903 atlases and maps.

The labor conditions in the printing trade caused greatly increased delay and expense in production of books and printed matter, but notwithstanding this we have completed the issue and distribution of the two important books notified last year; namely, "Battlefields of the World War: A Study in Military Geography" by Professor D. W. Johnson, and "The New World: Problems in Political Geography" by Dr. Isaiah Bowman. These publications have elicited warm praise from many of our Fellows and from eminent outside sources.

There are now in preparation various issues for the new year, some of which have already emerged from the printer and the distribution of which will receive due notice. We may briefly enumerate some of the titles without dwelling upon the contents, which will be duly chronicled in issues of the *Geographical Review*:

1. "Palisades Interstate Park"—a publication of particular interest and usefulness to the citizens of New York.

2. "The Agrarian Indian Communities of Highland Bolivia"—an intensive study of community organization amongst the primitive inhabitants of that country.

3. "The Position of Geography in British Universities"—a study in educational geography of wide scope and great usefulness in education.

4. "Recent Colonization in Chile"—which deals with the racial composition of the Chileans of today and with colonization methods of the government.

5. "The Rainfall of Chile"—a technical study of rainfall distribution that has influenced settlement.

6. "The Land System of Mexico"—a penetrating study of the evolution of a distinctive system of landownership and use.

7. "Legendary Islands of the Atlantic"—a charming and scholarly book on a classic theme.

8. "The State of Geographical Knowledge in the Eleventh and Twelfth Centuries"—a study of historical geography and the development of geographical thought.

9. "Walk Book of New York"—which promises to be fully as useful as the published booklet on the Palisades Park.

10. "The Face of the Earth as Seen from the Air"—a study in airplane geography that will be fully illustrated.

Announcement has already been made of the forthcoming publication of Bering's Voyages and Steller's Journal, which are related publications and will be issued together. The former will contain Bering's Log Book and a map showing his route.

There is ready for publication in co-operation with the National Research Council manuscript and maps dealing with the soils, vegetation, land classification, and rainfall of Africa.

The Alaska Road Commission of the United States has appropriated funds for the production by the Society of a map of Alaska on a scale of 1 : 1,250,000, a work involving compilations from all published and some unpublished sources, which promises to have high value in the development of the territory.

The publication of the *Geographical Review* as a quarterly periodical has met with unanimous approval. The volume of matter printed for 1921 is not far short of that printed in the monthly numbers of the *Review* in the previous year. The high standard of technical execution and the scholarly character of the articles have been matters of wide comment and assurance is given that the *Review* constitutes one of the three or four best publications of its kind in the world today.

Various other activities of the Society may be briefly alluded to.

The lectures have been well attended and appreciated. The speakers have been as follows: Mr. Robert Cushman Murphy, Dr. Edward L. Stevenson, Dr. Robert F. Griggs, Dr. D. G. Hogarth, Dr. Charles K. Edmunds, Mr. Alan G. Ogilvie, His Serene Highness Albert I, Prince of Monaco, Mr. J. O. P. Bland, Prof. Henry E. Crampton, Mr. William Beebe.

The work initiated in the geography of Hispanic America and Brazil, as described in last year's report, has been actively prosecuted with important and satisfactory results. From time to time there will be published in the *Geographical Review* a summary of activities in this department.

The annual convention of the Association of American Geographers was held for two days in April, 1921, under the auspices of this Society and was the occasion for an interchange of papers and consultation amongst distinguished representatives from various parts of the country. The Annals of the Association, which are published with the co-operation of our Society, maintain their high standard of useful contribution to science.

The Cullum Geographical Medal of the Society was bestowed upon Albert I, Prince of Monaco, for his distinguished scientific work in oceanography.

The Society has been called upon by the Government authorities to assist the Department of Justice in the study of the boundary dispute between Texas and Oklahoma along the line of the Red River for about five hundred miles. This call from the Government is a distinction of which the Society may well be proud and is in line with former service rendered by the Society in the Guatemala-Honduras Boundary dispute and at the Paris Peace Conference.

Mr. W. L. G. Joerg, Editor of the Research Series, was granted leave of absence during

the summer months for study amongst the departments of geography in European universities. He acted also as the Society's representative at the Centenary Celebration of the Geographical Society of Paris and attended the meetings of the Section of Geography and Geology of the British Association at Edinburgh. A report of his work will appear in the July number of the *Geographical Review*.

The number of the Fellows of the Society is 3,850, of whom 404 are Life Fellows.

The report of the Treasurer submitted herewith gives a condensed balance sheet and a summary of the income and expenses of the Society.

The staff of the Society deserves most cordial expression of appreciation for the efficiency of its work.

By order of the Council

PHILIP W. HENRY
Chairman

January 19, 1922

REPORT OF THE TREASURER FOR 1921

Receipts and Expenses

On December 31, 1920, there was a balance of income account	$465.60
During the year there have been received from annual dues, interest on investments, and sales of publications	67,904.78
	$68,370.38
There has been expended for salaries, house expenses, library, meetings, publications, postage, insurance, etc.	80,240.99
Balance carried to Capital Account	$11,870.61

Condensed Balance Sheet

Cash	$18,889.30	Annual dues paid in advance	$2,647.75
Sundry balances	236.20	Monograph Publication Fund	3,821.34
Balance of Capital Accounts	10,423.25	Hispanic-American Research Fund	7,618.31
		Sundry deposits and reserves	6,400.11
		Special deposits	9,061.24
	$29,548.75		$29,548.75

HENRY PARISH
Treasurer

REPORT OF THE SPECIAL COMMITTEE

January 19, 1922

The Special Committee appointed December 15, 1921, to nominate and invite suitable persons to fill vacancies which will occur in the offices of the Society at the date of its annual meeting in January, 1922, respectfully report that they recommend the election of the following gentlemen to the offices designated:

		TERM TO EXPIRE IN
President	John Greenough	1923
Vice President	James B. Ford	1925
Recording Secretary	Hamilton Fish Kean	1925
Treasurer	Henry Parish	1923
Councilors	Levi Holbrook Archer M. Huntington William C. Potter Charles A. Peabody Philip A. Carroll	1925

Philip W. Henry
W. Redmond Cross
Paul Tuckerman
Committee

Election of Honorary and Corresponding Members. At the meeting of the Council of the American Geographical Society held on February 16 a notable addition was made to the Society's membership lists in the elections of Honorary and Corresponding Members. No elections to these classes of membership had been held since 1918; and the present list, which is unusually long, may also be described as unusually representative and distinguished. The list follows:

HONORARY MEMBERS

MAJOR GENERAL ADOLPHUS WASHINGTON GREELY, of the United States Army (retired). General Greely is one of America's most distinguished Arctic explorers. His most important exploratory work has been described in "Report on the Proceedings of the United States Expedition to Lady Franklin Bay, Grinnell Land." He is the author of the "Handbook of Polar Discoveries" and of many papers on the climatology of the United States.

COLONEL SIR THOMAS HUNGERFORD HOLDICH, K. C. M. G., K. C. I. E., C. B. Colonel Holdich is a Vice-President of the Royal Geographical Society. He was formerly Superintendent of the Frontier Surveys, India, on which country he has written several notable works. He is an authority on boundary problems, his best known writings in this field being "Countries of the King's Award," "Political Frontiers and Boundary Making," and "Boundaries in Europe and the Near East."

LUCIEN GALLOIS, professor of geography, University of Paris. M. Gallois is one of the senior geographers of France. His earlier interests were in historical geography, in which domain "Les géographes allemands de la renaissance" is his chief work. He has since devoted himself to phases of human and regional geography, to which period belong "Régions naturelles et noms de pays: Étude sur la région parisienne" and numerous papers. Professor Gallois is one of the editors of the *Annales de Géographie*.

CORRESPONDING MEMBERS

GUNNAR ANDERSSON, professor of economic geography at the College of Commerce, Stockholm. Professor Andersson is president (1922) of the Swedish Anthropological and Geographical Society and editor of the Society's two periodical publications, *Ymer* and the recently founded *Geografiska Annaler*. He is the author of notable contributions in the field of plant geography, more particularly on the evolution of the post-glacial vegetation of Scandinavia.

CHARLES RAYMOND BEAZLEY, professor of history in the University of Birmingham, England. Professor Beazley is a member of the Council of the Royal Geographical Society. His work in historical geography is especially known through "The Dawn of Modern Geography."

JOSÉ J. BRAVO, Director of the Cuerpo de Ingenieros de Minas y Aguas, Lima, Peru. Señor Bravo is the author of many technical papers in earth sciences and an ardent worker for the promotion of geographical knowledge of Peru. He is president of the recently organized Peruvian Association for the Advancement of Science.

JAMES HENRY BREASTED, professor of Egyptology and oriental history and director of the Haskell Oriental Museum of the University of Chicago. Dr. Breasted's appreciation of the geographical factor in history is admirably illustrated in his important textbook, "Ancient Times: A History of the Early World."

JEAN BRUNHES, professor of geography, Collège de France, Paris. Professor Brunhes is known as one of the chief interpreters of human geography, author of that already classic work, "La géographie humaine." He has recently written two other important books in his chosen field—"Géographie humaine de la France" (Tome 1 of "Histoire de la nation française") and, with Camille Vallaux, "La géographie de l'histoire" (reviewed in this number of the *Geographical Review*).

HENRY CHANDLER COWLES, professor of botany at the University of Chicago. Dr. Cowles is the author of a "Textbook of Plant Ecology" and a student of many practical ecological problems.

BARON GERARD DE GEER, professor of geology at the University of Stockholm. Baron De Geer's chief work has been done in the field of post-glacial chronology, and his studies embrace the Fenno-Scandinavian realm and northeastern North America. He has also carried out geological and geographical investigations in Spitsbergen.

ALBERT DEMANGEON, professor of geography at the University of Paris. M. Demangeon,

well known as the author of a model regional geography, "La Picardie," is especially interested in the economic phases of geography. His striking study of the effects of the War on world commerce and industry has been published in Europe under the title "Le declin de l'Europe" and in America as "America and the Race for World Dominion."

GUILLAUME GRANDIDIER. M. Grandidier is secretary of the Geographical Society of Paris and editor of its journal, *La Géographie*. The chief sphere of his work is Madagascar. He has made important contributions to our knowledge of the natural history, history, and geography of the island. These include "Madagascar au XIXe siècle: Géographie, ethnographie, et zoologie;" "Bibliographie de Madagascar;" and, in collaboration with M. Alfred Grandidier, "Collection des ouvrages anciens concernant Madagascar" and "Ethnographie de Madagascar."

DAVID GEORGE HOGARTH, C. M. G., Keeper of the Ashmolean Museum, Oxford, England. Dr. Hogarth is intimately acquainted with the Near East, and, while his interests are primarily archeological, he has made notable contributions to the geography of that region, more particularly in "The Nearer East" and "The Penetration of Arabia." He is a member of the Council of the Royal Geographical Society.

MARK JEFFERSON, professor of geography at the State Normal College, Ypsilanti, Michigan. Professor Jefferson's extensive and original geographical writings are chiefly concerned with human geography and especially the distribution of population. He was leader of the American Geographical Society's expedition to the A. B. C. countries in 1918. The first part of the report of his investigations has been published in the American Geographical Society's Research Series as "Recent Colonization in Chile" and "The Rainfall of Chile."

CURTIS FLETCHER MARBUT, in charge of soil survey of the Bureau of Soils, U. S. Department of Agriculture, Washington, D. C. Dr. Marbut is a student of the application of physiography to the distribution and use of soils. He is joint author of a work on the soils of Africa to be published shortly by the American Geographical Society in collaboration with the National Research Council.

OLINTO MARINELLI, professor of geography at the Royal Institute of Higher Studies of Florence. Professor Marinelli is one of the foremost geographers of Italy and one of the joint editors of the *Rivista Geografica Italiana*. He has done important work in both physical and human geography. Many of his studies relate to the Italian Alps.

JOHN LINTON MYRES, O. B. E., Oxford, England. Professor Myres has devoted himself primarily to the study of Mediterranean archeology in its geographical setting. He is most widely known as the author of "The Dawn of History." He is a member of the Council of the Royal Geographical Society.

CHARLES RABOT. Dr. Rabot is a member of the Council of the Geographical Society of Paris and for eighteen years was editor of its journal, *La Géographie*. He is the foremost French authority on the geography of Scandinavia and the Arctic and the author of several books and numerous papers on these regions. He has also specialized in glacial studies.

SIR AUREL STEIN, K. C. I. E. Dr. Stein is Superintendent of the Indian Archeological Survey. His several explorations in Central Asia have resulted in notable advance in our knowledge of the early relations between China and the Western world. His latest publication is the monumental work "Serindia: Detailed Report of Explorations in Central Asia and Westernmost China."

LIEUTENANT COLONEL JEAN TILHO, of the French Army. For many years Commandant Tilho has been engaged in the pacification and administration of territories in the central Sudan. His important investigations of the period 1906–1909 have been published as "Documents scientifiques de la mission Tilho." During 1912–1917 he conducted a remarkable series of explorations in the regions of Tibesti, Erdi, Borku, and Ennedi, northeast of Lake Chad.

FREDERICK JACKSON TURNER, professor of history, Harvard University. Dr. Turner is a member of the Harvard Commission on Western History and of the National Board for Historical Service. He is the author of "The Frontier in American History" and "The Rise of the New West." His studies are especially distinguished by the application of geographical science to historical research.

ROBERT DECOURCY WARD, professor of climatology at Harvard University. Professor Ward is one of the leading authorities on climate in the United States. He is well known as the author of "Climate: Considered Especially in Relation to Man" and as the translator of Volume 1 of Hann's "Handbuch der Klimatologie."

NORTH AMERICA

Stages in the Development of the Sheep Industry in the United States. The history of pastoral industry in the United States is in no small degree a history of the frontier. The part played by cattle raising is well known: that of sheep rearing is less familiar, and it may be of interest therefore to summarize the paper "A Brief History of the Sheep Industry in the United States" by L. G. Connor in the last (1918) Annual Report of American Historical Association (Washington, D. C., 1921, Vol. 2, pp. 93–197).

In the first stage of the industry from its beginnings in 1609 to 1808, when the Embargo Act and its successor, the Non-Intercourse Act, checked importation, sheep raising was limited to the small flocks necessary to supply the wool which practically every household used for its own manufacture of coarse woolen cloth. From 1808 to 1830 the demand for fine woolens, formerly obtained from Europe, led to the establishment of many woolen mills; but the repeal of the Acts did much to counteract the stimulating effect of the application of power and the introduction of machinery into the American mills. Recovery came, however, with the return to normal conditions in European affairs in 1830; and the next decade and a half was marked by rapid growth of the industry in the East. It was the period of supremacy for the eastern wool grower, for the West as yet was limited to production for home needs.

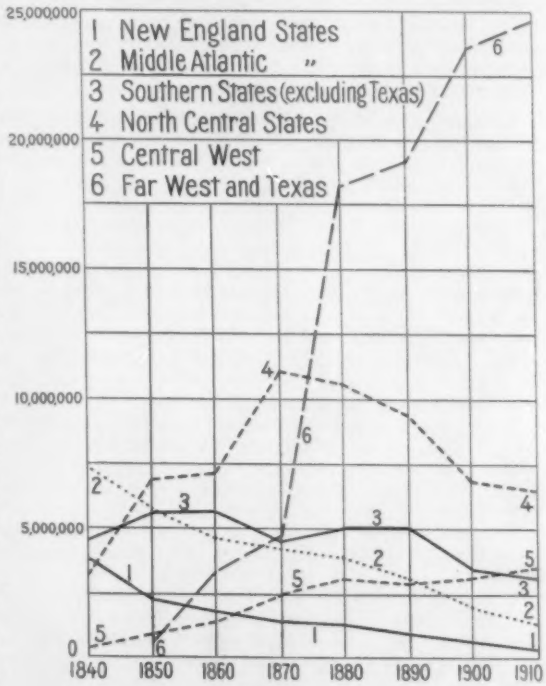

FIG. 1—Graph showing the number of sheep in the United States by major divisions at successive decades from 1840.

By 1845, however, the western migration of the wool sheep had begun on a large scale. The low cost of wool transport as compared with that of other farm products—wool was a profitable product 200 miles from the shipping point—gave such an impetus to the industry in the West that the East, in face of rising land values and increasing feeding costs, began to yield to competition. Decline in the flocks of the East was also accompanied by a characteristic change in the eastern sheep to the mutton type. The rapid advance of the industry in the Middle West during the period 1840 to 1850 slackened in the succeeding decade. The pioneer enterprise now experienced the competition of other branches of husbandry encouraged by the improvement of transportation facilities and by the opening of foreign markets. A particular stimulus was afforded by the market loss of Russian grain during the Crimean War. During the next few years the trend was reversed. The Civil War brought an increased demand for woolen goods to which both East and West responded by a rapid increase in the number of sheep. At the same time wool production on a large scale had commenced in the southern hemisphere—in Argentina, South Africa, and Australasia—and the close of the war brought a sharp decline in the price of wool and a reduction in the size of the flocks, especially in the East and in the North-Central States.

Expansion of the frontier, which had suffered temporary arrest, now entered on the last phase, and with it the last westward shift of the sheep industry. This stage was essentially different from the previous ones because of differences in natural conditions—the range where sheep rearing was a major enterprise as opposed to the farm where it was a minor activity. The greatest gain in the industry was made between 1870 and 1880 when the wave of expansion slackened, in part because of lower wool prices, in part by reason of the more fundamental cause, that it had been started in areas which proved more favorable for other activities, and also through overstocking of the range.

After 1890 the industry became concentrated in the Rocky Mountain region where the range conditions and the remoteness from markets gave this the advantage over other industries.

The frontier has gone: there are now no more great areas of unused land suitable for sheep, and the present grazing areas of the ranges are stocked to capacity. This capacity may indeed be increased by improved management, but such growth is necessarily slow. It seems that the industry has reached a turning point, and a movement of sheep "back to the farm" is likely to be initiated.

Economic Effects of the New England Ice Storm of November 26–29, 1921. What is believed to have been the worst ice storm in the history of New England occurred in that section in the latter part of last November. The storm, which continued unabated for over seventy hours, caused widespread destruction in that region. The sleet intermingled with rain froze to everything it struck; and trees, wires, poles, and buildings became covered with a thick glaze of ice. This glaze covering became thicker and thicker, and under the ever-increasing burden trees and poles groaned and creaked in the wind. Huge limbs, unable to stand the strain, crashed to the ground, and in some instances whole trees were uprooted. Elms, maples, and poplars were particularly heavy sufferers, while oaks and ashes seemed to weather the storm the best. Some idea of the destruction wrought upon trees can be had from the fact that in the city of Worcester, Mass., alone "between 7,500 and 8,000 trees were so badly damaged by the storm that they will have to be taken down at once and that from 5,000 to 7,000 others were so badly mutilated that their replacement must take place within a period of five years."

Trolley wires sagged and snapped, branches and poles fell across the tracks, leading to a complete suspension of service. So great was the damage that in central Massachusetts it was three weeks before trolley service reached a normal state again. Railroad service also was seriously disrupted. Towers carrying high tension power wires were also felled, and this led to many communities being without power. In those places the industries which depended entirely upon electricity were obliged to close until service could be restored. Over 40 cities had their electric lighting systems put out of commission by the storm.

Telegraph and telephone systems were badly crippled. Hundreds of poles and miles of wire fell, and both local and long distance services in many instances were completely demoralized. Hundreds of unskilled men were set to work after the storm cleaning up the débris. Experienced repair crews were brought in from distant points, and in the first ten days after the storm they had strung 100,000,000 feet of wire in an effort to link up New England with the rest of the world. Telephone officials state that the storm will cost them nearly $1,500,000, while telegraph men say that their loss is equally as great. Altogether it is estimated that property was damaged to the extent of $3,000,000.

Regarding the cause of the storm G. F. Howe and C. F. Brooks say, "The unusual duration of this ice storm seems to have been due to a large supply of cold air flowing southwards, and of warm air going northwards above it. The cold wind at the surface, as is usual when sleet or ice storms occur, formed a barrier over which the warm wind had to rise. It was this rising and the consequent cooling by expansion which reduced the vapor capacity of the wind aloft and thus produced rainfall. The two currents in this case were surprisingly well balanced" (*Bull. Amer. Meteorol. Soc.*, Vol. 2, 1921, p. 140).

GUY HARVEY BURNHAM

SOUTH AMERICA

A Vegetation Map of Venezuela. A welcome addition to the scant data on Venezuelan vegetation has been made by Henri Pittier, now Director of the Commercial Museum of Caracas. On a map (Mapa ecológico de Venezuela que demuestra las zonas naturales, los

cultivos, las viás de comunicación y los principales centros mineros, etc.) of scale 1 : 2,000,000 natural vegetation is represented by five green tints (not too easy to distinguish) and cultivation by two yellow tints. Other useful data shown are communications and mining centers, and the map is accompanied by a descriptive text (Esbozo de las formaciones vegetales de Venezuela con una breve reseña de los productos naturales y agrícolas, Caracas, 1920).

The areas ascribed to the main types of vegetation differ considerably from other recent estimates—a higher figure is given to the wooded area while that of the land under cultivation is much reduced. On a total area of some 403,000 square miles (1,043,900 sq. kilometers, Almanach de Gotha) the percentages are woodland 52, savana 45, *páramos* 0.35, cultivated land (not including artificial pastures) 0.4. The very small amount of land under actual cultivation, about 1,610 square miles, is striking. The higher figures of earlier estimates may be due to inclusion of other areas of cultivable land or land that has been once under cultivation, for in common with other countries of tropical America the *conuco* system is general in Venezuela, and there are considerable areas of abandoned clearings (compare the article on "The Forests of the Dominican Republic" in this number of the *Review*). Not less striking than the small area devoted to agriculture is the limited use of the forests and grasslands. Their potentialities have long been recognized in a general way, but they still remain almost unknown scientifically.

The forested areas include four types, dry woodlands, monsoon forest, tropical rain forest, temperate forest, to which might be added a fifth, the mangrove forests fringing the Orinoco delta. The dry woodland exhibits two facies, thorn forest and chaparral. Thorn forest (*espinares*) occurs at various points along the coast from the peninsula of Goajira to Paria and on Margarita and the adjacent islands. Chaparral is found in very dry districts of the interior, usually at elevations below 1,000 meters, and in proximity to the savana into which formation it merges without sharp distinction. At times it is difficult to distinguish the chaparral from the *rastrogos*, second growth vegetation on abandoned clearings. It corresponds on a small scale with the *caatingas* of Brazil. During the rainy season the dry woodlands exhibit a luxuriant verdure, but the appearance of aridity is not entirely lost: it is expressed by several permanent features—the reduced size of the trees, the relative thinness of the undergrowth, and the presence of such forms as the cacti.

The monsoon forests are a transitional formation between the dry woodland and the rain forest. In the dry season they present an appearance similar to the former; in the rainy season to the latter. The monsoon forest is, however, distinguished from the dry woodland by the abundance of lianes and woody vines and the larger size of the trees. It is differentiated from the rain forest by the seasonal change of aspect, for in the dry season a number of the trees completely lose their foliage. This type occupies about two-thirds of the forested area of Venezuela. It covers the maritime cordillera between the thorn woodland and the temperate forests and a broad belt at the foot of the Andes and the western sierras. Its maximum development, however, occurs in Venezuelan Guayana.

The tropical rain forest occupies the Andean slopes south and southeast of Lake Maracaibo, the lower valley of the Tocuyo, and a belt in the south from the Rio Negro and Upper Orinoco basins along the divide of the Guayana highlands. This type has the usual characteristics of the storied tropical rain forest. Emphasis must be laid on the variation of forest composition from place to place regarding which we are almost completely ignorant.

No definite altitude can be fixed as the lower limit of the temperate forest. It is best described as coincident with the zone of maximum precipitation, the cloud zone. It is more varied than the tropical rain forest, and a number of deciduous species are included in its composition. It presents considerable similarity to the monsoon forest from which, however, it may be distinguished by the nature of the ground cover, composed characteristically of tree ferns and including genera of small palms (*Geonoma* and *Chamaedorea*). It attains a considerable development in the Andes and the coast cordillera, but, though the chief towns and agricultural districts occupy clearings in this forest, its characteristics remain little known.

In the Andes and the highest peaks (Silla de Caracas and Pico de Naiguatá) of the coast cordillera the temperate forest gives place at higher elevations to *páramos* whose xerophytic vegetation is comparatively well known.

The common picture of the famous llanos as vast monotonous stretches of grassland is far from correct. As Codazzi has pointed out, there are great variations in different parts. The main types may be shortly described. The *pajales* or *pajonales* extend from the slopes

of the coast cordillera to the center of the llanos. They appear as a thick grassy cover more or less interrupted by bands of monsoon forest and are described as "parkland" or "gallery forest" according to the predominance of savana or woodland. The parklands are best developed towards the west on the foothills and the gently sloping plain traversed by the middle courses of the affluents of the Apure. They offer conditions highly favorable for human settlement—abundant water, fertile land, natural pasture, though the lower parts may suffer from inundation. The gallery forest type is best seen in Alta Guayana along the Caura and other streams. The *mesas* offer a sharp contrast. They are sandy, permeable wind-swept areas, without trees, without water, scantily covered with a herbaceous vegetation. The *mesas* constitute the more elevated portions of the eastern llanos north of the Orinoco (Sievers distinguishes them on his vegetation map of Venezuela, *Petermanns Mitt.*, Vol. 42, 1896). The *morichales* are so named from the occurrence of the moriche palm (*Mauritia flexuosa*). This type borders the left banks of the Apure and Orinoco to near the delta. The soil is humid or swampy, and the vegetation remains green and fresh in the driest season; whence these are concentration points for cattle in search of water and pasture. The southwestern part of the savanas between the Apure and the Meta presents the aspect commonly associated with the llanos, vast level stretches, grass-covered, broken only by occasional groves. A tree border is usually lacking from the watercourses, and during the rainy season great areas are inundated.

These are the main types of the savana, but the transition forms are infinitely varied. Of details regarding the vegetation nothing is known; though such knowledge would form the basis for a serious attempt to utilize the enormous grazing resources of the llanos and would doubtless help to throw light on the vexed problem of their origin (see Eugene Van Cleef: Rainfall Maps of South America, *Monthly Weather Rev.*, October, 1921).

Chilean Ethnological Expeditions to Tierra del Fuego. The fast vanishing tribes that peopled the archipelago south of the Strait of Magellan have been the subject of study by several scientific parties in recent years. (For a complete summary of the results of these and earlier investigations see J. M. Cooper's "Analytical and Critical Bibliography of the Tribes of Tierra del Fuego and Adjacent Territory," in *Bur. of Amer. Ethnology Bull. 63*, Washington, D. C., 1917.) Stimulated by the example of scientists from other countries and having their attention attracted to the region by the celebration of the four-hundredth anniversary of Magellan's discovery of the "Land of Fire," Chileans themselves have recently sent two small expeditions to study the Indians of the region (Martín Gusinde: Expedición a la Tierra del Fuego, and *idem:* Segundo viaje a la Tierra del Fuego, *Publs. Museo de Etnología y Antropología de Chile*, Vol. 2, 1920, pp. 9–43 and 133–163, Santiago).

Señor Gusinde's primary object was to investigate the customs, myths, and language of the two tribes, the Onas and the Yahgans, or Yámanas as he calls them, using the term which they themselves emplóy. The former are guanaco-hunting people that now have been forced into the forested districts in the southeastern part of the main island; the latter, canoe folk who live in the numerous channels to the south. (Compare the descriptions by C. W. Furlong in the *Geogr. Rev.*, Vol. 3, 1917, pp. 1–15 and 169–187.) Ethnological collections for the Museum in Santiago were also made. Gusinde visited the temporary encampments of the few survivors of these two tribes and was particularly fortunate, it would seem, in that he was able to witness and even to participate in some of the ancient ceremonies still observed by the Yahgans (Yámanas). By his intimate contact with them during several months he was also enabled to collect many data regarding their myths and traditions. The papers above referred to contain, however, little more than the account of the expeditions, since the scientific results are to be published at a later date.

Gusinde also adds somewhat to existing knowledge regarding the third tribe of Fuegian Indians, the Haush, who formerly occupied the extreme southeastern end of the main island, but of whom there are said to remain only two or three representatives. He promises to publish his conclusions regarding the ethnic differences that exist between this tribe and the Onas, as also an opinion concerning the probable origin of the former. Brief mention is made of the Alaculoofs, the other canoe tribe that inhabits the channels of western (Chilean) Patagonia and some of the water passages in western Tierra del Fuego, among the least known of all the tribes of America. (Other recent contributions to the study of these last-mentioned people are, Aureliano Oyarzún: Los indios Alacalufes, *Publs. Museo de Etnología y Antropología de Chile*, Vol. 2, 1920, pp. 165–170; and R. Lehmann-Nitsche: El grupo lingüístico Alakaluf de los canales magallánicos, *Rev. Museo de la Plata*, Vol. 25, 1921, pp. 15–69.)

Of particular geographical interest are Señor Gusinde's corrections of the map of Tierra del Fuego issued by the Chilean Oficina de Mensura de Tierras (1 : 500,000). He states that there exists, near the headwaters of the Rio Grande, a lake called Lago Blanco (longitude 60° 5′ W., latitude 53° 58′–54° 12′ S.) which measures about 35 kilometers in length and more than 15 kilometers in width. It appears to be drained by the Rio Blanco, one of the upper tributaries of the Rio Grande, and to receive the waters of the Rio Cochrane (which the map shows flowing directly into the Rio Grande) which in turn drains another lake, Lago Chico, that lies south of Lago Blanco. The river that appears on the map as Rio Cochrane, Gusinde says, is really the Rio Catalina. He also asserts that Lago Lynch is far larger than shown on the map, being some 20 kilometers long, and that it lies 20 kilometers farther west than indicated. Since all of the northern part of the main island is being taken up as sheep ranches, and whites are settling also at many points farther south, as well as upon various smaller islands, it is evident that many further details can soon be inserted in the blank spaces on these maps.

FIG. 1—Map of Spitsbergen showing the area covered by the Norwegian expeditions of 1919, 1920, and 1921. All of the territory west of the line running from the northwestern corner of Wijde Bay to the east of South Cape has now been surveyed by the series of Norwegian expeditions of 1906–1921. The expeditions of 1906 and 1907 were carried out under the Prince of Monaco, the later expeditions were supported by a subvention from the Norwegian government and by private enterprise.

POLAR REGIONS

Norwegian Explorations in Spitsbergen, 1919, 1920, and 1921. In my article "The Norwegians in Spitsbergen" (*Geogr. Rev.*, Vol. 8, 1919, pp. 209–226) a summary notice was given of the scientific work being carried on by Norwegians in West Spitsbergen. This work includes the topographic and geological mapping of the coal-basin regions and a hydrographic survey of the west coast, of which the prime object was to facilitate navigation of the coal-carrying vessels. Under the direction of M. Adolf Hoel, who has been one of the leaders of the annual expeditions since 1911, the surveys have been continued in 1919, 1920, and 1921 and are now practically completed. A résumé of the most important results has been received in a communication from M. Hoel.

Ice conditions were very favorable in 1919; the west coast indeed had never been so ice-free since 1898. Only during two short periods was drift ice encountered and then only in small quantities. During the summer of 1920 the sea remained almost equally ice-free. From July 6 to August 31 M. Hoel saw only some few masses of ice carried by the northward-setting current. This favorable situation was prolonged during the succeeding winter (1920–1921), which proved to be an absolutely abnormal season. During this entire season the west coast was practically ice-free. Even the fiords were generally open: from

time to time a layer of ice would form on the surface but only to break up and disappear during some subsequent storm. As early as April 13 a steamer was able to reach the coal wharf of Kings Bay (78° 55′ N.).

On the other hand, by the middle of June ice originating on the east Spitsbergen coast had doubled South Cape and arrived on the west coast, where it remained all summer extending northward to the southern point of Prince Charles Foreland. Broken up by numerous channels it offered, however, no very great difficulty to navigation. This extraordinary seasonal distribution of ice appears to be due to the predominance of easterly winds during the winter of 1920–1921 and the succeeding summer. During the winter the pack ice from the northern and eastern parts of the Barents Sea was frozen fast and could not be carried to the west coast by the easterly winds, but, when the spring break-up came, it moved westward under the influence of the winds—a movement general throughout the polar seas north of Europe.

During the three seasons of 1919–1921 M. Hoel and his colleagues were engaged in the region extending from Ice Fiord to South Cape. Here they surveyed 386 square miles in 1919 and 579 square miles in 1920 but in 1921 only 154 square miles on account of the impediments offered by the great quantity of ice. Thus the survey of the west coast of West Spitsbergen is almost completed, and in the near future Norway will publish a map on the scale 1 : 100,000 or 1 : 200,000 from the northern coast to the most southerly point of the island with a breadth of from 13 to 62 statute miles. A chart of the west coast from Cross Bay to South Cape will also be constructed.

As regards geology considerable results have been obtained during these last three years. The geological map of the coal basin of central Spitsbergen on the scale 1 : 50,000 has been completed from the west coast up to a line from Björndal (a valley opening on to the eastern shore of Ice Fiord to the southwest of Advent Bay) to the mouth of Conway valley in Van Mijen Bay. A geological map of the coal basin on the southern shore of Kings Bay on the scale of 1 : 10,000 has also been made.

On the most recent and most complete geological map of Spitsbergen (Geologische Kartenskizze von Spitsbergen . . . von A. G. Nathorst in his "Beiträge zur Geologie der Bären-Insel, Spitzbergens und der König-Karl Landes," *Bull. Geol. Inst. of Upsala*, Vol. 10, 1910) the entire coast zone between Horn Sound and South Cape is represented as pertaining to the Hecla Hook stage (Lower Silurian, regionally metamorphosed). The field work of 1919 and 1920 has shown that this zone is constituted by less ancient and more varied formations. Besides the Hecla Hook stage Carboniferous, Permian, Triassic, Jurassic, and Cretaceous deposits are represented. Another result no less important is the discovery of crinoids in the Hecla Hook stage, thanks to which it is now possible to assign a definite age to this formation. It has also been ascertained that the Devonian, which in this part of Spitsbergen has been known only from an outcrop on the southern shore of Horn Sound, occupies a relatively extended area towards the south.

In the southern part of the west coast Quaternary shore lines were observed at elevations of 1,100 feet where previously they had not been recognized at elevations above 460 feet.

CHARLES RABOT

British Exploration in Spitsbergen in 1920. In the July, 1921, number of the *Geographical Journal* J. M. Wordie describes the results of his work in Spitsbergen. The first few weeks of the 1920 season were spent in Prince Charles Foreland, the classic ground of Dr. Bruce's explorations. A noteworthy feature of the field work was the ascent of Mt. Monaco, 3,450 feet, whence light was gained on several geological problems regarding both the central mountain group of which this peak is the loftiest member and the island as a whole.

On July 22 the expedition left for Stor Fiord, the great waterway separating Barents and Edge Islands from the main island. The fiord is usually difficult of entry until late summer. With the commencement of the break-up of the polar pack drift ice is carried westward past the mouth of the fiord; a portion swings in and is held there until driven out by northeasterly winds. Such were conditions in 1919, and they appear to be usual. In 1920, an abnormal year (see note on Norwegian Explorations above), the waters were very open, permitting visits to many points on the shores. Among the sections visited were Barents and Edge Islands where it was found that, contrary to general belief, the ice covering is of small extent, being confined to the central and eastern portions; "for

the rest both islands are cut up by wide, moderately fertile valleys, which afford excellent feeding ground for the small remaining stock of reindeer."

One object of the visit to Stor Fiord was revision of the coast line as laid down on the Admiralty Chart which is based on the observations of Nordenskiöld in 1864 (the topographic results of the Russian expedition to measure an arc of meridian in 1898–1902 have never been published and presumably must be regarded as lost). The results accomplished here included elimination from the map of the "low flat island" off Whales Bay, an error traceable to the ancient Dutch charts. Depths of 91 and 75 fathoms were found on the site of the mythical island.

Following the description of the work done in Stor Fiord Mr. Wordie makes some comments on the glaciation of Spitsbergen. Adopting the classification of R. E. Priestley in the Scott Antarctic Expedition memoir on glaciology (now in course of publication), he summarizes it thus: "Spitsbergen is covered in the higher parts by sheets of highland ice having their outlet towards the coast as valley glaciers; as a rule these end as such, but in exceptional cases piedmonts and allied ice-formations are developed. This represents the diminished stage of a much more intense glaciation, and if it is considered desirable can be called the 'Spitsbergen stage' of the glacial cycle." The great extent of former glaciation may be considered proved by the accumulated evidence of such phenomena as high-level erratics and raised beaches (steady rise in the land being correlated with steady decrease in the ice of the interior). Topographical evidence is largely lacking, for under the frigid climate rapid frost weathering and the consequent accumulation of talus tend to a speedy obliteration of glacially molded contours. The opinion is expressed that, with local advances, retreat of the glaciers has been constant since the period of the last great ice flood. At present they are in retreat with few exceptions.

On coal mining, which promises to be the dominant industry in the future of the island, Mr. Wordie quotes some recent and suggestive figures. Coal is now mined at Kings Bay, Cape Boheman, Advent Bay, Green Harbor, and Braganza Bay (head of Van Mijen's Bay). In 1919 some 90,000 tons were exported, and it was expected that the figure for 1921 would reach 200,000 tons. The deposits are estimated at 9,000,000,000 tons, sufficient to supply the Scandinavian and other northern markets for many years. Cost of transportation—which is at present very high—will be an important control of output.

PHYSICAL GEOGRAPHY

Forecasting the Crops from the Weather. In an earlier note (*Geogr. Rev.*, Vol. 11, 1921, p. 295) mention was made of the fact that the yield of cotton can be more accurately forecast from mathematical analysis of weather factors than from the reported condition of the crop itself. And this seems to be true of most crops. The yields of a crop in the various years of record are compared with temperature and rainfall conditions in each of the months or selected combinations of months during and preceding the growth of the crop. The relations found may then be used as factors or additive elements in arriving at an idea of the probable yield, the estimate becoming better and better as the successive critical periods are passed. R. H. Hooker, who in 1907 made a successful forecast of England's crops through the use of weather data, chose in his presidential address before the Royal Meteorological Society to discuss the history, present status, and outlook in "Forecasting the Crops from the Weather" (*Quart. Journ., Royal Meteorol. Soc.*, No. 198, Vol. 47, 1921, pp. 75–99). There are two bases on which such forecasts can be made: one is periodicity, and the other, the known effects of weather preceding or during the growing season. Our knowledge of cycles is as yet too indefinite to allow forecasts of value to be made year after year. One of the troubles seems to be, as Hooker points out, that there are too many cycles of varying period operative at the same time.

Nevertheless, Professor H. L. Moore has brought forward strong evidence in support of an 8-year cycle ("Generating Cycles Reflected in a Century of Prices," *Quart. Journ. of Economics*, Vol. 35, 1921, pp. 503–526, and "The Origin of the Eight-Year Generating Cycle," *ibid.*, Vol. 36, 1921, pp. 1–29). After establishing the closeness of the relation between crop yields and prices and showing for each during the last few decades the likelihood of the existence of an 8-year cycle, in England, France, and the United States, he extends the period of his investigation back to 1818 on the basis of wholesale prices (Sauerbach's indices), and to 1760 by the use of the price of grain (Poynting), both in Great Britain, and finds the same 8-year cycle extending back at least 160 years. The cycle, it appears, is a combination

of one of 7.38 and another of 8.73 years. For this apparent cycle in crop yields and the necessarily corresponding one in prices there should be a meteorological cause. Analyzing the rainfall of May and June in the Dakotas, and annual rainfall in the Ohio Valley and in Illinois, Professor Moore finds an apparent 8-year cycle corresponding to that in crop yields. He cites the 7.3-year cycle (cf. the 7.38-year component of the 8-year cycle) in the rainfall-controlled annual growth of trees on the central plateau of Arizona. He also points to the 8-year periodicities in winter barometric pressure in central Europe and to the apparent 8-year period in the pressure of the United States. The crests of the 8-year pressure, rainfall, and crop-yield cycles in the United States and Europe have come generally in the years 1874, 1882, 1890, 1898, 1906, and 1914, or a year earlier. As it is reasonable to expect a cosmical cause for congruent cycles found in North America and Europe, Professor Moore calls attention to the 8-year period in the distance between Venus and the earth, Venus having been nearest us in the years 1873, 1881, 1889, 1897, 1905, 1913, and 1921. While conjunctions of these two planets occur every 1.6 years, it is only at every fifth conjunction, or every eight years, that Venus is nearly or actually between the sun and the earth, owing to the fact that the orbits of Venus and the earth do not lie in the same plane. How this could affect the earth's weather is a difficult question: Professor Moore suggests that since Venus always has the same face to the sun, the resulting perpetual tempest on that planet, from the cold side to the hot one and return may have some effect on the passing solar radiation, and therefore on the earth's weather.

The results of a searching and highly suggestive investigation of economic cycles in western and central Europe have just been published by Sir William H. Beveridge ("Weather and Harvest Cycles," *Econ. Journ.*, Vol. 31, 1921, pp. 429–452). Instead of an 8-year cycle a 15.3-year cycle and especially its double, a 30.6-year cycle, and still longer ones are indicated. After having discovered the 15.3-year cycle in exports from Great Britain, the author found it confirmed by harmonic analysis in records of European wheat prices since 1550. In seeking an explanation, he shows that this cycle probably arises from a temporary combination of two or more shorter ones, namely: cycles of 4.374, 5.11, and probably also 2.74 and 3.71 years. The first and last correspond to well-known periods in sun spots and solar prominences, respectively, while the other two are in evidence in meteorological records. It may be noted here that the 7.38-year and 8.73-year cycles, which Professor Moore thinks may be factors of the apparent 8-year cycle, are almost exactly double the 3.71-year and 4.374-year cycles, respectively. Harmonic analysis confirms the supposition that there is an elemental cycle of 5.11 years in wheat prices but does not offer convincing proof for the 4.374-year cycle. Important conjunctions of the four short cycles occur at intervals of 123, 148, 271, and 608 years, which are strikingly apparent in European famines during the past thousand years. It seems that the effects of these cycles taken individually are not very important, e.g. plentiful rainfall accompanying the crest of a cycle acting alone may produce an excellent crop, whereas the excessive rainfall on the conjunction of rainy peaks of two cycles occurring during a critical portion of the crop season is likely to make a poor harvest. Sir William urges further investigation immediately, before the arrival of 1923, which, being 608 years after the worst famine in the history of western Europe and 123 years after the memorable dearth of 1800, may be one of rain, cold, and bad harvest, and therefore lead to a disastrous economic year for that region in 1924.

Whatever may be the outcome of a further study of this 8-year cycle, the immediate possibilities of the use of our knowledge of the effects of current weather on the growing crops are highly encouraging. What we know about weather and American crops is ably summarized by our chief investigator in this field, Professor J. Warren Smith, in his "Agricultural Meteorology" (New York, 1920; see elsewhere in this *Review*). Those investigations mentioned by Hooker relate mostly to the eastern hemisphere. So far as is known the earliest attempt to estimate the size of a crop by the weather was that of Governor Rawson, of Barbados, who in 1874 published an account of how the sugar crop in hogsheads amounted to 800 times the inches of rainfall of the year preceding the growing season. Gilbert and Lawes, in 1880, found that a temperature higher than average and a prevailing deficiency of rain in winter and spring lead to the highest yield of wheat. Sir Napier Shaw, in 1905, found that the yield of wheat in England was 39.5 bushels per acre minus five-fourths of the previous autumn rainfall in inches. Then Hooker compared wheat yields with temperature and rainfall statistics at all periods of the 18 months before harvest and found that the rainfall between mid-September and early November was the most important. Apparently, just as in eastern Maryland, there is more than enough rainfall for wheat, so that the less

the better. In a region in India where the autumnal rainfall is evidently usually too little for starting wheat, S. M. Jacob found (1910) that the more rainfall in autumn the better the yield. Evidently there must be regions where the rainfall is such that any deviation from the average should give a reduced yield. In Scotland, where A. Watt, in using the ordinary correlation method, could find no connection between spring rainfall and the yield of oats, the usual weather conditions appear to be just right, for in drier England Hooker found that the more spring rain the better the yield of oats.

By using a more or less rough cut-and-try method suitable for showing crop-weather relationship under optimum conditions, Kincer found factors that give a theoretical yield of cotton in Texas showing a correlation coefficient of 0.88 with the actual; and Jacob, with weighted rainfall factors and the subsequent yield of wheat in Jullundur, obtained a coefficient of 0.91. A. Walter has probably carried out the most exhaustive analysis on any single crop. The degree of wetness (monthly rainfall corrected by the ratio of rainy days to total days) at various periods of the year was compared with the yields and a formula obtained. Then the residuals were correlated with temperatures. On the basis of both rainfall and temperature the yields are indicated quite accurately—so much so that in three years when hurricanes did great damage the difference between the actual yield and the computed yield has been set down as the damage done by the hurricanes, and the theoretical yield has been offered to insurance underwriters as the basis for settling damage claims after a hurricane.

For different regions, on both sides of the optima the most thorough work has been done by A. Wallén, in Sweden, who has charted the correlation coefficients between rainfall and temperature on the one hand and the four cereals (wheat, barley, oats, and rye) on the other, for each of the 26 governments of Sweden in every month of the growing period of the crop during the thirty years 1881–1910. His theoretical yields come very close to the actual. For the same crop the correlations in the north may be the opposite of those in the south, indicating that normal weather in the south may perhaps be too warm and moist for certain phases of the crop's development, whereas the normal weather in the north is too cool and dry. Mathematical treatment leading for each crop to the determination of a curve showing closely the weather control over yield would probably establish general laws applicable in any region.

Hooker deprecates the lack of application of the results already shown to be of such value in the actual forecasting of crops. He points out, however, that there is much more that can be learned about the relation between weather and crops if only the properly qualified persons will attack the large mass of exact data now available for such comparisons. Under Louis Dop, chairman of the Committee on Agricultural Meteorology, the International Institute of Agriculture at Rome is trying to direct the efforts of agricultural meteorologists all over the world. With adequate knowledge of the detailed relationship of the weather elements to the condition of crops we could modify farm practice as regards planting in order to bring a critical stage of the crop at a time most likely to have favorable weather. With forecasts even for a few months in advance, substitute crops could be raised to prevent an imminent crop failure, or at least steps could be taken in advance of a crisis to insure sufficient food supply. Few investigations hold out such promise of valuable pre-harvest safeguards, against a threatened scarcity of food.

CHARLES F. BROOKS

HUMAN GEOGRAPHY

Recent Movements of Population. The political, social, and economic causes with which the great migrations of the past have been associated have never before been at work on such a gigantic scale in the three continents of the Old World at the same time. In this statement is found the moving idea of the author of an able and extremely interesting review entitled "The Migration of the Races" (*The Round Table*, March, 1921, pp. 241–273). The laboring classes have long acquired a mobile character which makes them responsive to the factors affecting migration. They are supplied in their own language with tempting information on distant parts of the world. The Slavs and Italians particularly were accustomed before 1914 to work in mines and on railways in other countries of both Europe and America and return seasonally to their own. In spite of all the causes, associated with the war, that checked immigration into America, there threatened a turn of affairs that would swamp the United States with low-class aliens having no training in the processes of

modern democracy and no appreciation of their own political responsibilities and opportunities. How far can a policy of restricted immigration be carried? Australia proposes to maintain her homogenity even if this means that she is to remain without an adequate population. She fears to lose her internal unity if she admits incompatible elements. Where will this bring the empire? Will an artificial dam prove strong enough to keep out the colored races?

The restlessness of the human race was never so great as today. Some old tyrannies have disappeared, but new ones have sprung up. Hatreds are even stronger than they have been in the past. So intense is the feeling against the restrictions and difficulties of the Old World that not even the present want of means for the journey or the business depression in the new countries to which the emigrant would go are sufficient in themselves to hold back the tide. In 1907 over a million and a quarter immigrants entered the United States, and in that year President Roosevelt appointed a commission to study the subject and directed public attention to the importance of regulating immigration. In 1917 a literacy test was introduced and the admission tax raised. The war of course stopped the flow for a time, and, in the first half of 1919, 4,000 more people left the United States than entered it. In 1920 the tide had set again this way, with 430,000 arrivals, though 288,000 aliens also left the United States in that year.

We thus see the disarrangement of war in still another of its aspects—its effect upon the movement of peoples. Before the war a complex, widely extended economic system had been developed. Its success depended upon a continuance of that security which had brought it into being. Instead of stopping the flow of emigration from Europe and Asia the war tended to hasten it. Agriculture alone cannot absorb a notably large number of people immediately, and it is immediate relief that the would-be immigrant desires. He does not look forward to a future day when business will revive, for he has no capital on which to subsist, and his whole habit of mind is one of direct relation to the problem of food, clothing, and shelter.

From being largely an economic problem, as before the war, the migration of peoples has become now also a political and a social problem. America has built up her railways, her municipal improvements, and her great mills and factories to a very large degree upon imported labor. At the same time that the streams of labor were pouring into the country, her agricultural production was so high that streams of agricultural products were crossing the ocean to industrial Europe. With the continued industrialization of the United States the ratio of export declined, but the manufacturer still clamored for cheap labor. "Improvements in machinery enabled them to do without much intelligence or skill, but cheap labor was indispensable." The native-born American did not wish to engage in the work that thus fell naturally into the hands of the immigrant. Rapidly expanding industrial enterprises took care of the incoming laborer and the second generation of laborers also, the best of whom drifted into other occupations.

By contrast European lands enjoyed a more balanced life, and their populations were more sensitive to stimuli abroad. In the case of the United Kingdom, 20 per cent of the grain and vegetables consumed were imported (for 1913), and 60 per cent of the meat supply. Germany imported 20 per cent of her whole food supply, and France 20 per cent of her grain and vegetables and 60 per cent of her meat. The question of food is thus fundamental to the question of the movement of people in those countries, just as the early Greek colonies in Asia Minor were dependent in part upon the question of food, and just as Japan has sought an outlet for her population in recent years. If life presses upon the individual at home, the modern fast steamship and the lure presented to him by the steamship company and by the country desiring his aid prove too much for him, and he responds quickly and in large numbers. So long as we were confident of our political and social systems, so long as they seemed to work to our advantage regardless of the plight of the incoming laborer, we were little bothered by his influence upon our life, even though we knew that our democratic institutions and ideals meant little to him. It is a commonplace that the war showed that the old bonds between the immigrant and the home country were so strong that we could not count upon a united country. This focused attention upon the character of our alien elements. "Much as our vineyards need laborers we have a lamp to keep alight."

At first our immigrants were chiefly from northern Europe. Latterly they have been from southern and southeastern Europe. The grand total of American immigrants from the British Islands is still larger than from any other country. It stands at almost exactly 25 per cent for the last hundred years, and about half of our entire population is reputed

to be Anglo-Saxon by race. All this is changing, and the change is taking place now. It affects not merely our political forms and social institutions, but it also affects the quality of our people. It would be rash to claim that the last word in democracy will be spoken by Anglo-Saxons. The ultimate goal may be reached by some other race, but the public and its leaders are profoundly convinced that the state of education and the intellectual character of the populations of southern and eastern Europe dilute and weaken our national character, if they do not introduce a positively explosive element into it.

Complementing the paper described above reference may be made to an article, "Les migrations internationales de 1901 à 1920," in the October, 1921, number of the *Bulletin de Statistique générale de la France*. The article referred to consists largely of statistical tables covering the emigration and immigration of the more important countries for the past 20 years. Figures for the United States for 1921 are also available and are specially interesting in regard to the working of the Immigration Act of 1921 which limits the yearly quota from any of the countries of the Eastern Hemisphere to 3 per cent of the total of residents in the United States at the last census who were born in that country. The total number of immigrants admissible for 1921–1922 under this act is 355,825 (not 358,448 as in the article) as compared with 805,228 who entered in the fiscal year 1920–1921, and 1,218,480, the total for 1913–1914. It is probable that the quota for 1921–1922 will not be filled since only 189,421 were admitted from June, 1921, to January 31, 1922. Quotas, however, for the following countries and regions have already been exhausted: Greece, Yugo-Slavia, Poland, Eastern Galicia, Portugal (including the Azores and Madeira), Spain (including the Canary Islands), "other Europe" (including Andorra, Gibraltar, Malta, Memel, Monaco, San Marino, Iceland), Palestine, Syria, Turkey, Smyrna District, "other Asia" (including Mesopotamia, Persia, Rhodes, Cyprus, and territory other than Siberia which is not included in the Asiatic Barred Zone), Africa, Australia, New Zealand, and "Atlantic Islands." Whereas the Polish quota is now exhausted, aliens from the area between the "Curzon Line" near Brest Litovsk and the Treaty of Riga boundary are still admitted, being charged to the quota of Russia. Immigrants from Bessarabia also are charged to Russia rather than to Rumania. It will be noticed that the United States has been obliged to practice a recognition of the new territorial arrangements, including plebiscites, because of the restrictions of the new act. This recognition is not to be regarded as having any political significance, however, or as involving the recognition of new governments, boundaries, or transfers of territory except as have already been formally recognized.

Cuba, the figures for whose average yearly net immigration for the periods of 1905–1913 and 1915–1918 are practically the same (21,000), alone maintained during the war an immigration figure comparable to prewar figures. There the falling-off of European immigration has been met by an influx of Haitians and Jamaicans. During the war and up to 1920, emigration from Australia and the Argentine Republic exceeded immigration into those countries. On the contrary, statistics show that, whereas before the war emigration in Great Britain, Spain, and the Netherlands exceeded immigration, more arrivals than departures were registered from 1915 to 1918 (transportation of troops is not included in the figures). There is some question, however, as to what proportion of these figures represent actual emigration and immigration, since Holland counts as migrants all who change the country of residence for however short a time while Great Britain counts only those who change residence for a year or more.

At present Great Britain and Ireland are rapidly returning to prewar emigration. Italians are going largely to France. Belgians, also, whose emigration figure for 1919 is 38,400, the largest in the history of the country, are going in large numbers to northern France, from which they will eventually return. Large numbers of Belgians, too, came to the United States in 1919, as did also practically the entire emigration from the Netherlands, which in this year was 45,400, exceeding all previous figures.

The article suggests that the steamship companies which made a business of transporting emigrants to the United States will attempt to turn the tide toward South America now that it is evident that immigration into the United States is to be restricted for some time to come. It is to be noted, however, that the countries of western Europe seem likely to fail to fill their quotas for the current fiscal year.

Spanish Emigration. Much has been said about the tide of Spanish immigration into America, but definite statistics regarding this movement have seldom been given. The issuance of "La Emigración Española Transoceánica, 1911–1915" (Madrid, 1916), an

official publication of the Higher Council of Emigration (Consejo Superior de Emigración), supplies many important data concerning this matter. According to the official figures there published, the total transoceanic emigration during the five-year period referred to amounted to 602,081, or over 3 per cent of the population of the country. Furthermore, in the above figures is not included the emigration from Spain via foreign ports, which sometimes reaches a fourth part of that officially recorded, nor the emigration to other European countries and North Africa. Adding this we find that the emigration to America was nearly four per cent of the total population. But for the abnormal conditions (economic crisis and the World War) which marked two of the five years (1914 and 1915), the numbers would probably have been far beyond the figures given, since the curve of emigration was rising rapidly during the years 1910–1913.

It is evident that Spain views with a certain amount of concern such an exodus of her inhabitants. But she also recognizes the movement as a natural expansion, which, if properly directed and followed up, offers her an opportunity to recover something of her former influence in America; an influence which was gradually diminishing from the time of the wars of independence until the loss of Cuba and Porto Rico in 1898, when Spain ceased to figure in the affairs of the New World. Under proper direction this new movement of her people to the western hemisphere might mean a re-conquest of Hispanic America, not political but cultural.

The greater part of the emigrants from Spain go to the Argentine. In 1913, for example, of the 151,000 emigrants 101,636 had that country as their destination, while during the entire five-year period those who went to the Argentine numbered 403,164, out of a total emigration of 602,081—a little over 66 per cent. So great, in fact, was the movement of people from Spain to the Argentine in these and preceding years that from 1910 it occupied first place in the current of immigrants into that country, outnumbering even the influx from Italy, which had formerly topped the list.

Cuba was a poor second in the number of Spanish emigrants received during this five-year period, though in 1915 she actually received a larger number than the Argentine. Her total for the five years is given as 135,759, or 22.5 per cent of the total. Next in order came Brazil, though with but 31,516 (or 5 per cent) during the period. Other countries figuring prominently in the list were Uruguay, Mexico, and the United States.

The larger part of the immigration from Spain was from the regions of Galicia, Asturias, and León, in the northwest. The provinces along the Mediterranean (except Castellón, Tarragona, and Gerona) also contributed largely to the tide of emigrants, as did also the north-central provinces in Old Castile, Navarre, and the Vascongadas. In general the coastal provinces, probably because in closer contact with maritime travel, were more largely represented in the emigration than those farther inland. Vigo, Coruña, Barcelona, and Almería were the favorite ports of departure.

Contrary to the usually accepted idea, the writer of the volume on emigration above referred to declares that there does not exist the so-called "swallow" migration between the La Plata region and Spain. There is a constant movement to and fro, a movement which corresponds closely to the harvest seasons in the two countries which, lying on opposite sides of the equator, have their seasons reversed; but this, it is asserted, is not the result of a seasonal migration of the same individuals. The return movement is rather of those who have spent some years in the South American countries and choose the close of the summer season there as the best time to return to their former homes. A like consideration is thought to influence the time of departure from Spain, since the months of September, October, and November show the highest rate of sailings. It would seem doubtful if the earnings obtained by a few months of harvest labor, even with the high wages paid in the La Plata region, would warrant any such seasonal migration of individuals as is often spoken of. However, more detailed statistics than those published by the governments concerned would seem necessary to establish the facts in regard to this seasonal movement.

GEOGRAPHICAL NEWS

Association of American Geographers

Seventeenth Annual Meeting. The Association of American Geographers met in Washington December 29–31, 1921, for the seventeenth annual meeting. The sessions were held in Hubbard Memorial Building by invitation of the National Geographic Society.

The Presidential Address of Miss Semple, entitled "The Influence of Geographic Conditions upon Ancient Mediterranean Stock Raising," was delivered at the afternoon session of December 30. It gave in outline the results of a thorough study of the subject from classical sources and from observations made during a recent journey in Greece. Miss Semple laid stress upon the continuity of response to environment throughout the long period of from three to two thousand years, dwelling especially on the seasonal movements of peoples engaged in pastoral pursuits and on the peculiar adaptability of different regions for the raising of particular kinds of stock.

Twenty-seven papers were announced on the final program, all of which were given with the exception of "The Barrier Reef of Tagula, New Guinea," by Professor W. M. Davis, which was read by title. "The Problem of Representing the Earth's Surface on a Map" was given by Oscar S. Adams (introduced by William Bowie), and there was a paper on "Some Results of the Recent Cruise of the *Carnegie*, 1919–1921," by L. A. Bauer and J. P. Ault. General physiography was represented by "Certain Features of Arid Region Topography," by N. M. Fenneman; "The Evolution of the Stepped Canyon Profile of Glaciation," by F. E. Matthes; and "Shore Changes Due to Current and Wave Action," by G. T. Rude.

A number of papers discussed aspects of the physical geography of the United States: "A Proposed Alteration of the Physiographic Map of the United States," by N. M. Fenneman; "The Trend of Land Utilization in the United States," by O. E. Baker; "A Soil Map of the United States" and "The Soil Geography of the Northern Great Plains," by C. F. Marbut; "Topographic Types about Nashville," by A. E. Parkins. Dealing with the human side were "Some Regions in the United States with Stationary Population," by R. M. Harper; "City Growth and City Advertising," by Robert M. Brown. Human utilization of regions was the basis of "A Regional Economic Map of North America," by J. Russell Smith.

H. N. Whitford spoke on "The Climatic, Genetic, and Economic Relations of the Forests of the Torrid and Temperate Zones," and, C. S. Scofield on "Limitations of Irrigated Agriculture."

Papers in the Latin American field were given by O. F. Cook, "Peru as a Center of Domestication," and E. F. Bransom (introduced by H. H. Barrows), "Geography of Eastern Costa Rica." Regional papers outside of the Americas were "Geographic Setting of Chengtu, China," by George D. Hubbard, and "Urundi," by H. L. Shantz.

Work of the National Geographic Society was described by Gilbert H. Grosvenor, "The National Geographic Magazine," and N. M. Judd (by invitation), "The Pueblo Bonito Expedition of the National Geographic Society." Two papers dealt with educational geography: "Twenty-Five Years' Growth in Collegiate Geography" (in the United States), by George J. Miller, and "Some Observations on the Status of Geography in Western and Central Europe," by W. L. G. Joerg. J. Paul Goode spoke on "The American Need for Authority in Fixing the Form of Foreign Geographic Names." A survey of the publications of the Association was made by Richard E. Dodge in "A Decade of the Annals."

Members of the Association were afforded an excellent opportunity of learning something of the geographic work in the Federal Service. This was the theme of the Round Table Conference held at the evening session of December 29 at which the discussion was led by A. H. Brooks and C. F. Marbut. Work in the various departments was described as follows: State Department by Colonel Martin, Hydrographic Office by G. W. Littlehales, Geological Survey by P. S. Smith, Bureau of Plant Industry by H. L. Shantz, Bureau of Farm Management by O. E. Baker, Bureau of Soils by C. F. Marbut, Bureau of Fisheries by H. F. Moore. At another session an interesting series of papers (requested) dealing with geography and trade was contributed by W. S. Culbertson of the U. S. Tariff Commission ("Colonial Tariff Policies"), Julius Klein, of the U. S. Department of Commerce ("Geography in the Bureau of Foreign and Domestic Commerce"), and E. S. Gregg, of the U. S. Department of Commerce ("Influence of Geographic Factors on Ocean Shipping"). One of the most interesting features of the meeting was the social evening held at the Geological Survey Building at which was given an exhibition of geographic work and a demonstration of map methods of the Survey.

Joint Meeting of the Association of American Geographers and the American Geographical Society. At the building of the Society on April 28 and 29, there will be held the annual joint meeting of the Association of American Geographers with this Society.

A preliminary program is in preparation and will be mailed to all out-of-town Fellows upon request. The final program will be distributed a week before the meeting and will also be printed in full, with a brief synopsis of each paper, in the July number of the *Geographical Review*. This brief preliminary announcement is made in order that anyone interested may have the opportunity of attending the meeting.

Obituary

Julius von Hann. It is nearly half a century ago that Julius von Hann began to take his place as the universally acknowledged leader of meteorological science, and for many years previous to his death he stood out head and shoulders above his fellow workers. He grew up with and himself was, as it were, a large part of the rapid modern development of meteorological science. He was able, through his intense application and industry, and because of his great intellectual powers, not only himself to contribute largely to the advance of his science but also to keep closely in touch with all the work which was being done by investigators and writers everywhere. For years his many contributions to the *Meteorologische Zeitschrift*, often modestly signed J. H., were never-failing evidence of his truly extraordinary grasp of his subject and of the universal range of his reading. He was, as fully as any one human being can be, a living encyclopedia of his chosen science. And this is in no sense to be taken as suggesting that his mind was merely a storehouse of dry, hard facts. He was very human. He saw the many and varied relations of meteorology and climatology to human life and activities, and he was always on the lookout for opportunity to emphasize these relations. His writings were always clear, vivid, and interesting. His "Handbuch der Klimatologie," for example, which inevitably has to deal largely with "dry" statistical details, is enlivened throughout by carefully selected, vivid, first-hand descriptions of weather types and of human or botanical responses to the climatic environment.

His fellow workers who remain are dynamic or physical meteorologists, or climatologists, or are specializing in this or that subdivision of their science. This is a natural and inevitable situation at the present stage of our knowledge of the atmosphere. It cannot well be otherwise. But it leaves a great gap which no one man can ever again fill, because meteorology has now grown to such an extent that specialization is the rule, and no single mind will ever again master all of its details. Hann's "Lehrbuch der Meteorologie" is the one absolutely indispensable textbook in that science. Upon his "Handbuch der Klimatologie" all studies of climatology must, for years to come, be based. This extraordinary grasp of the whole wide range of his science he maintained practically till the day of his death.

Somehow, when a man like this passes away, a bare statement of the essential facts of his life and a list of his contributions to science seems unnecessary and futile. Yet there is something singularly significant in the fact that this man, living a very simple life, with very few changes of residence, extended his interests and his reading to all parts of the world. He knew the geographical and climatological conditions of almost every corner of the globe as intimately as if he had himself lived there. Hann—for thus, and not as von Hann, he will oftenest be recalled—began life as a school-teacher. At the age of twenty-nine he entered the Central-Anstalt für Meteorologie in Vienna. From 1874 to 1897 he was its Director, an office from which he retired at the age of fifty-eight. For many years he was also Professor of Cosmical Physics at the University of Vienna. His work for meteorology did not cease when he ceased to be Director. He soon went to Graz, where, in the Physikalisches Institut, he wrote his "Lehrbuch der Meteorologie," whose three editions bear the dates 1901, 1906, 1915. The "Handbuch der Klimatologie" he wrote while in Vienna. The three editions of this book bear the dates 1883, 1897, 1908–1911. These two books are Hann's monumental publications. It is almost literally true that no student of meteorological science can do a day's work without referring to them. Throughout his long editorship and joint editorship of the *Meteorologische Zeitschrift* (1866–1920) he steadily contributed to the pages of that journal a series of articles and notes which are invaluable, for in these he revised, summarized, commented upon, and put into permanent form a vast body of meteorological and climatological material.

Hann died in Vienna, October 1, 1921, in his eighty-third year. No more fitting tribute could possibly be written of him than that contained in the notice of his death sent out by his former colleagues in Vienna. "Ein Leben ununterbrochener Geistesarbeit und reinster Forschung im Dienste der Wissenschaft ist abgeschlossen. Aber ungezählte Fäder führen von Hann's Werken in alle Länder der Erde und wirken in seinem Sinne fort."

R. DeC. Ward

SIR ERNEST SHACKLETON. With the death of Sir Ernest Shackleton Britain loses one of the most brilliant explorers of modern days. Shackleton began his career of Antarctic exploration as a member of Scott's 1901–1904 expedition in the *Discovery*. Characteristically enough he was one of the party of three that achieved the "farthest south" of that date, reaching to within 463 miles of the pole. In 1907 Shackleton returned to the Antarctic with his own ship, the *Nimrod*, on an expedition notable for its employment of new methods and equipment and for its striking results. Like the succeeding expeditions, it was a purely private enterprise. Of the results it is enough to say that Mt. Erebus was climbed, the Magnetic Pole was discovered, and a journey was made via the great Beardmore glacier to within 100 miles of the pole. Among polar expeditions it stands out as one "well conceived, well planned, and well carried out," as Edwin Swift Balch says in his review of "The Heart of the Antarctic" (*Bull. Amer. Geogr. Soc.*, Vol. 42, 1910, pp. 9–21). Among the many honors bestowed on its author was the Cullum Geographical Medal of the American Geographical Society.

Immediately on his return from the Antarctic Shackleton gave his interest and support to the proposed Australasian Antarctic Expedition, the command of which he handed over to Mr. (later Sir) Douglas Mawson. He himself worked out a project for crossing the Antarctic continent from the Weddell Sea to the Ross Sea. The *Aurora*, which had been engaged in the Australasian expedition, was detailed to proceed to Ross Sea with a party to lay a chain of depots to Beardmore glacier for the transcontinental journey. This was accomplished; but meanwhile the ship broke away, leaving this section of the expedition stranded in winter quarters, whence they were ultimately rescued by the *Aurora*, with Shackleton on board. The *Endurance* carrying the Weddell Sea party was still more unfortunate. After cruising along Coats' Land she was caught in the ice on January 15, 1915, and drifted northward until October 27, when she was crushed. Shackleton and his party continued drifting northward on the ice floe until April 12, 1916, when they made for Elephant Island. The story of the leader's bold journey in a small open boat to South Georgia (750 miles) and across the mountainous, glacier-clad island on foot to the whaling station and of his repeatedly attempted and ultimately successful rescue of the marooned men left behind under Frank Wild is well known and justly acclaimed as one of the greatest epics of polar exploration (see *Geogr. Rev.*, Vol. 2, 1916, pp. 54–57; 231–232, and Vol. 3, 1917, pp. 245–246; 397). Shackleton's own story of the expedition is told in "South" (1920).

On this return from polar regions Shackleton served in the army—as officer in charge of supplies for the British forces in the White Sea and northern Russia—until conclusion of the war released his energies for further polar work. He at first planned an expedition into Arctic waters, to the Beaufort Sea, but subsequently he decided to return to the Antarctic to carry out investigations in the practically unknown Enderby Quadrant and various little-known sub-Antarctic islands. The *Quest* left England September 24, 1921, and after a stormy voyage entailing trying delays she had only reached South Georgia when on January 5 her commander died suddenly at the age of 48. In accordance with what would undoubtedly have been his wishes the expedition will continue under the leadership of Wild, while Shackleton has been buried in that remote island on the threshold of the Antarctic.

Shackleton's personality was not less interesting than his exploits. To his commanding personality, his courageous and indomitable spirit, and certain quality of "instinctive judgment" that together made for leadership in a supreme degree tribute is paid by Hugh Robert Mill in a recent number of *Nature* (February 2, 1922), and a splendid portrait, "Sir Ernest Shackleton: A Study in Personality," is sketched by Charles Sarolea in the March number of the *Contemporary Review*.

GEOGRAPHICAL REVIEWS

Arctic America as a Pioneer Belt

Vilhjalmur Stefansson. **The Friendly Arctic: The Story of Five Years in Polar Regions.** xxxi and 784 pp.; maps, ills., index. The Macmillan Co., New York, 1921. $6.50. 9 x 6 inches.

"There may no longer be a Far West, but there is a Far North with the same nebulous and glamorous future within which shall rise stately cities and empires of productivity." In this sentence from page 670 of "The Friendly Arctic" Vilhjalmur Stefansson summarizes his creed. While others prefer to live farther south and in a warmer climate, a few, including Stefansson, prefer the Arctic. On the same page, one learns that "Mr. Seymour lives in the Arctic rather than anywhere else;" Storkerson prefers it also, and the list is lengthening yearly. If Daniel Boone were alive, he would probably be a denizen of the Arctic. It is the great undeveloped pioneer land of the world. There are vast prairies of grass for the support of reindeer herds and musk oxen, or ovibos, as Stefansson prefers to call them. It is commonly thought that the only useful vegetation of the snow-free surfaces of the Arctic is "mosses and lichens," but Stefansson frequently emphasizes the presence of grass—unused but useful, short but nutritious, snow-covered for a part of the year, but the snow cover is thin.

We are told that the man who goes to the Arctic must use his wits, and we judge from the adventures of Stefansson that he must use his wits constantly and that they must be of exceptional quality if he is to succeed. Thomsen lost his life in a blizzard, apparently, though he stepped away from his snow house only a yard or two. After conferring about the course of the *Karluk*, Stefansson and Bartlett decided to stand off the land at a greater distance at a critical point on the north coast of Alaska. Stefansson found out later that this was a very serious mistake of judgment. Had they stood closer in, the vessel might not have been lost. But the best judgment at which these two experienced Arctic explorers could arrive is acknowledged to have been an error. The results we already know: the *Karluk* drifted westward in the grip of the sea ice and was finally lost; several members of the scientific staff and crew died of nephritis; others who went out to explore the ice never returned; one committed suicide. Out of a total personnel of more than seventy, as listed on pages 758–760, sixteen lost their lives on what is said to be the best equipped polar expedition that was ever organized.

We have referred to Thomsen. His companion was Bernard. After Thomsen's death Bernard advanced farther along the coast of Banks Land. He had access to abundant stores of food separated by moderate distances. All trace of him was lost. It is thought probable that he perished in trying to go forward over the sea ice.

The mistakes of judgment that involve the loss of a number of lives, accidents that result in death, suicides—if one were to become absorbed in these evidences of the *un*friendliness of the Arctic one might be led to frame an old-fashioned and convincing story of Arctic hardships and of the impossibility of future development of these now all but empty lands.

Here is where Stefansson shows qualities that we believe no other polar explorer has possessed. He refuses to be stampeded by the dangerous and the romantic. He is not out to make himself a hero. He is studying a problem, and he reports on it. In his way of thinking the Arctic has undeveloped resources, and the resources of the earth are being strained to supply the ever-growing needs of a mounting population. Among the dwindling resources of the world are grasslands. The rise in the price of meat will continue. Nothing can stop it. It is an established economic law. It surely follows that pasture lands of wide extent and that may be grazed by an animal like the reindeer, perfectly adapted to the kind of pasture that the Arctic affords, will not long remain in a state of disuse. Whatever the inconveniences, whatever the dangers, the increasing cost of meat will impel men to exploit the prairies of the North.

It would be a mistake to suppose, however, that the book deals only with the material aspects of the future of the Arctic. To a thoughtful person it is the most fascinating book of polar

exploration yet written in any language—for the story it tells, the breadth of its philosophy, and the style in which it is written. Everything is set forth with simplicity and directness. No one else has written on the Arctic with such charm and lucidity, and surely no one else has so frankly swept aside the romantic phases of his many adventures and coldly analyzed them from the standpoint of ideal achievement. It seems as if every experience was played upon by an ever active mind, intent on getting the inner meaning out of Arctic life and not in carrying home brightly painted pictures of strange scenes and people. It deserves to be ranked among the great classics, like Livingstone's "Travels in Africa," to which it bears many striking resemblances, and Doughty's "Travels in Arabia Deserta," and a few others.

Our first view of a country is always the romantic one. Over the edge of the horizon is something strange. The world wants to hear about it. The audience carries the speaker off his feet. Ultimately the strange becomes better known and must be interpreted, not merely described. It is, therefore, the natural time for such a book on the Arctic to appear. Stefansson will stand for all time—not merely because of "The Friendly Arctic," but also for "My Life with the Eskimo"—as the great interpreter of the North.

Stefansson does not hesitate to blame others for their blunders and failures, but he is no more sparing with himself. It was almost inevitable that there should arise a clamor of criticism regarding his management of the expedition. Obviously it was not closely organized within itself. The several parts were to do work on a semi-independent basis. A wide field had been laid out. Each leader of a party was assumed to be a man who could meet a great emergency. In a too closely organized and minutely directed expedition difficulties arise because specialists are not given sufficient liberty of action. Stefansson chose a wiser and a broader course. He sought to pick big men and put them upon their own responsibility. When difficulties arose he met them in a spirit of concession. Only a broad-minded leader could have taken the course which he took in the face of a threatened mutiny of part of his staff. And later on in his book he gives generous praise to the scientific results of those who had earlier sought to defeat his purposes. Of his courage or of special strength in facing physical obstacles and dangers he makes light at every turn. And while it is true that one recognizes a capacity for physical endurance, the thing that stands out is his power of philosophical thought.

The scientific results of the expedition are to appear in a series of monographs, and an appendix to the book tells of the work of the southern section of the expedition. It is thought probable that the complete scientific results will involve years of further research work and the publication of more than twenty, and possibly thirty, volumes. Several hundred miles of coast line were surveyed, and positions and outlines were corrected; new lands were discovered beyond the northwestern border of the Canadian Arctic Archipelago as previously delineated upon the charts; a scientific study was carried through of the vast copper-bearing rocks on the Arctic fringe of the Canadian mainland; ethnological collections and studies of wide scope and importance were conducted upon Eskimo groups that are still measurably free from white influences. Soundings and meteorological observations were made which extend our knowledge of the ocean floor; the regimen of the currents and the sea ice was studied, and climatic data were assembled. Stefansson himself thinks that it is not the formal scientific results of the expedition that are the most valuable part of it, "but rather the general change in the trend of the world's thought which should follow from a broad consideration of what was done and of how it was all done." "It is not only ignorance but also romance that retreats before the advance of knowledge" (p. 687).

The most challenging thing about the book is its title. A question insists on repeating itself, no matter how coldly analytical one's mood: Is the Arctic really friendly? We have referred to the loss of life on this splendidly equipped expedition. Now there is an occasional suicide in the Temperate Zone. Naturally it may occur in the Arctic. Peary considered George Borup the best man in his party as a pioneer in trail breaking. Though only a boy in years, Borup was a man in physical strength and resourcefulness. With a single Eskimo he made a long hunting journey for musk oxen by moonlight and survived every peril of the North. He lost his life by falling overboard from a motor boat in Long Island Sound! Death is commonly less of a mystery than an accident. If Thomsen lost his life in a blizzard within a few feet of his hut, and he an experienced polar traveler, so do the annals of the pioneer record loss of life from blizzards on the prairies of North Dakota, Kansas, and Nebraska. A freeze following a sudden thaw may cover the ground with ice and cause great loss of life among reindeer that may come to thrive on the Arctic prairies some time in the future, but frosts now and then also kill many of the orange groves of

Florida and southern California. Grasshoppers may devour the crops in Guatemala and the Argentine, and a storm may scatter and destroy a fishing fleet in the North Sea.

What are the distinctive risks of the Arctic? For one thing, in a pioneer region the risk of death is greater than in organized and developed communities. If you break a leg in the Arctic or get typhoid fever there, you cannot call the doctor by telephone or expect him to arrive within the next hour. Not only the pioneer of the Middle West and the Far West but also his wife and children took risks, and many suffered death because of pioneer conditions pure and simple. To that extent the pioneer belt was not friendly. So the prairies of the Far North are to be taken as part of a pioneer zone, where loss of life will be relatively heavy and where friendliness is but relative. It is also true that many people lose their lives because they have not the wit to meet an emergency, but if they truly have not the wit they cannot be blamed for losing their lives. No matter what the sources of a man's thought about it may be, whether in cheap story books or bad textbooks or his own instincts, if he thinks the Arctic is terrible, terrible it is to him, and he can hardly be blamed for it if it drive him to insanity or suicide or only keep him in organized communities where there are kin and so-called comforts and a sense of security. The things that matter in the tendencies of a people are not only the objective facts of their environment but also what they think about the facts. Group behavior is not a good basis for proving that man is a rational animal. The tide will be long in turning to the northern prairies. The Arctic will not be called friendly by the majority of thinking people who read about it even in Stefansson's pages; it is truer to say that the Arctic has been friendly to Stefansson.

A Symposium on Political Problems of Mexico, Central America, and the Islands of the Caribbean

G. H. Blakeslee, edit. **Mexico and the Caribbean.** Clark University Addresses. x and 363 pp. G. E. Stechert & Co., New York, 1920. 9 x 6 inches.

One of the most practical of the attempts that have been made in the last twenty years to obtain a frank exchange of views between thoughtful people in Hispanic America and the United States is this volume of addresses delivered at Clark University in 1920. The organization of the matter, under the editorship of Professor Blakeslee, is most happy. Four introductory chapters deal with fundamental factors, that is capacity for self-government on the part of Mexicans, the character of the Mexican people, the Indian element, and the question of health. A second section takes up special problems, such as oil, railroads, labor, and reconstruction. A third includes a study of recent conditions, the present revolution, the relation of the United States to Latin America, etc.; and a fourth deals with Central America and the islands of the Caribbean.

The best papers in the book are the first and the last. The Honorable T. Esquivel Obregón, Minister of Finance in the Cabinet of Mexico in 1913 and Lecturer on International Law at Columbia University, has a brief introductory paper setting forth six fundamental facts to support a conclusion regarding the capacity for self-government among Mexicans. For our people it is one of the ablest and most constructive political documents in the English language, because it is entirely frank and it springs from a wide knowledge of human nature as well as from a knowledge of the specific problems of the Mexican people. The last address deals with the subject of Porto Rico. While maintaining an attitude of sympathy with the overlordship of the United States, the author, Pedro Capó Rodríguez, Spanish editor of the *American Journal of International Law*, handles the problem of Porto Rican relations in a thoroughly statesmanlike manner.

These and other thoughtful papers in the volume emphasize repeatedly what might be called the first fundamental fact in a study of Hispanic America—that the point of view of the institutions and the spirit of our people and those of Hispanic America are fundamentally dissimilar. The Latin American people look to the older cultures of Europe to satisfy their taste and manners, their philosophy and their ideals. Contributing powerfully to the fostering of this relationship is the better shipping service to England and France from South American ports, the closer similarity of language, and the European view of the social and political problems of the day. There is a racial difference between us and the people of Hispanic America that is even more nearly fundamental. Our ethical standards are unlike; and, though our political forms are superficially similar, there is

the widest divergence of view in the practical application of liberal constitutions to the present needs of the people. Back of this divergence also is an age-old and basic dissimilarity in social and political ideals.

In recent years we have further complicated the problem by advance into the Caribbean, and one after the other of the papers in this volume emphasizes the difficulties and downright antagonisms that have resulted from such an advance. Our people have not gone into Hispanic America in large numbers to settle and develop the country. They have gone in as exploiters for business purposes, and political control under these conditions cannot be anything else than an artificial thing. Our geographical proximity to the Caribbean and to Mexico and Central America has obliged us to establish political relations that are not in harmony with the liberal tendencies of our government and of our time. Yet it has seemed as if we could not escape the imposition of strange political forms and ideals upon the adjacent republics because of the responsibilities that inevitably fall upon us in consequence of our interpretation of the Monroe Doctrine. With an eye single to business and to strategic control we pass over the finer elements in Hispanic American life. We do not cultivate an acquaintance with the lawyers and authors of Hispanic America. We do not seek them out and attempt to understand their point of view. Our business representatives expose but one aspect of American life, and it is this aspect which fills the entire horizon of many Hispanic Americans who try to understand us. The consequence is that our entire culture appears materialistic and to a high degree selfish and even hostile.

The sum of these influences is set forth clearly and unmistakably in one after the other of the addresses in this volume. The geographical and territorial facts recited merely emphasize this conclusion. The book contains little of suggestion as to the settlement of these problems. It merely presents them. It must be read by every geographer who wishes to understand the problems of trade, of human distributions, the development of resources, and the political geography of Hispanic America. For statesmen it is the beginning point in any sound consideration of a problem in international relations that forms one of the two or three major problems confronting the United States today.

Economics of Argentine Agricultural Exports

E. W. Schmidt. **Die agrarische Exportwirtschaft Argentiniens.** xv and 296 pp. (Probleme der Weltwirtschaft, No. 33.) Gustav Fischer, Jena, 1920. 9½ x 6½ inches.

If political science includes the economic life of nations Ernst Wilhelm Schmidt, Doctor of Political Science, reflects the greatest credit on his training by this book. It is admirable—a great credit to German science and scholarship.

The "Economics of Argentine Agricultural Exports" deals with the grain and cattle products of the Argentine Republic. It is clearly written and illustrates its points by means of 82 little tables which are wonderfully illuminating. The list of them does a good deal to take the place of the missing index. The treatment is strictly scientific, a statement of relations and elaboration and demonstration, unenlivened by pictures or expressions of feeling. Reference to the author's year of travel in the Argentine is limited to the preface.

For Schmidt the Argentine Republic is restricted to the "main agricultural zone," contained in the provinces Buenos Aires, Santa Fé, Córdoba, Entre Ríos, and the Territory of the Pampa Central. This is the geographic region known as the Pampa. Its area is about a quarter that of the Republic. It is a great treeless, pebbleless plain of loess, well supplied with humus, with a mild, temperate climate and rains that usually suffice for crops, though recurrent droughts are a great drawback. It is covered with natural grasses that are "tender" (*pasto tierno*) in the southeast—Buenos Aires, southern Santa Fé, and Entre Ríos—and tougher, less nutritious (*pasto fuerte*) in the north, southwest, and west. On these plains the Spaniards released Andalusian cattle brought in the sixteenth century from Spain by way of Peru. They multiplied rapidly, a tough, bony breed, equally resistant to weather, thirst, hunger, and the teeth of the consumer. But the hides made good leather and the meat, lacking fat, was most suitable to make jerked beef. The hides were the only commodity the early Argentines had to exchange for European wares with the smuggling English and Portuguese at a time when Spanish colonial policy made trade at Buenos Aires illegal. The founding of the Viceroyalty of the Rio de la Plata and permission to trade with Spain and other colonies gave the trade in hides a great impetus, still more independence (1810), and free intercourse with all nations. By 1820 there had grown up

a large business in supplying jerked beef for Cuba and Brazil. It was cheap, nutritious food for slaves, as in the Argentine it was a cheap, abundant food, consumed in enormous quantities by Creole Argentines whose lower classes hardly knew any other nourishment.

With the introduction of chilling and freezing plants in the middle of the nineteenth century came the importation of English stock to produce a fatter, juicier beef, better adapted to the English taste. With improved stock came the need of better fodder, and alfalfa began to replace even the famous *pasto tierno* of the southeastern pampas. The creole cattle of the *pasto fuerte* zone still maintain themselves as hide producers and in the north, being immune to a cattle malaria that destroys improved breeds there, still supply jerked beef through establishments in Entre Ríos and send stock to the *saladeros* of Uruguay and southern Brazil, though in diminishing quantities. Similarly creole cattle are driven over the Andes to Chile from Mendoza and San Juan—an old, old business with a crop that traveled, self-propelled, to market.

Until nearly 1890 the grain production of the country did not satisfy home needs, and wheat and flour had to be drawn from Chile where agriculture had an earlier start. The grain raisers in the Argentine were the new immigrants of the last 50 years. The gaucho of the Pampa was by birth and instinct a horse and cattle man, entirely averse to any form of agricultural labor. Immigration and, after it, the railways to carry agricultural products to the seaboard were the two developments needed to spread wheat- and corn-raising over the whole agricultural region. At length the farm exports have become equal to and in many years greater in value than the cattle products. Between them these products of the soil make up four-fifths of the billion dollars' worth of Argentine exports. Argentine agriculture is always extensive and mostly ignorant, like the European immigrants who practice it. Too rarely the farmer owns the land he tills, such being the case on about a third of the farms. These farms are probably the smallest ones, so that they do not represent a third or anything like a third of Argentine agriculture. Agriculture suffers from the dominance of exportation and large landownership. Local consumption of farm products is very small, quite the opposite of the case with grazing, for it is believed that three times as much meat is consumed in the country as is exported. The southern hemisphere situation, having summer when the north has winter, combines with the difficulty colonists experience in acquiring small plats of land, to discourage immigration while encouraging seasonal visits of harvest laborers from Italy and Spain, who return north with the sun and have no permanent stake in the country. Control by export needs and large ownership combine to limit farm operations to a single crop and make well-nigh impossible the crop diversification and home improvement that the national department of agriculture advocates so zealously. If the creole working class takes naturally to horses and cattle, so does the creole landowner too. He has no taste for agricultural undertakings. However, he has introduced English "pedigreed" cattle and must put part of his *estancia* into alfalfa to feed them. This he turns over to the immigrant colonist on a moderate rental with a contract to plant wheat two or three years and put in alfalfa seed, supplied by the owner, with the third-year crop, the land then reverting to the original owner, who can return his cattle to it for another ten or fifteen years. Thus a considerable expansion of Argentine grain exportation has accompanied the introduction of fine cattle into the country without permanent increase of farming land but with the addition of seven and a half million hectares of alfalfa land in twenty years—an interesting play between the two chief occupations and interests of the inhabitants of the republic.

The future of the country demands more people. If it were possible for them to acquire land suitable for agriculture which is now in private hands, yielding a poor return by sustaining poor cattle on natural grasses, there would be room for a large number of intelligent immigrants. They could have comfortable and attractive homes on farms diversified with fruit, vegetables, grain, and cattle, and they could make Argentine fields produce larger quantities of meat and grain for export than any other region. The United States has ceased to have a surplus of either grain or meat, having a great industrial population to feed at home. Such a population can never grow up in the Argentine Republic on account of her lack of fuel. But Argentine lands have been alienated to influential persons in large blocks till the government has practically none in the best agricultural regions. Will the republic obtain immigrants of the required intelligence? Will the needed lands be taken from private owners and given to the immigrants? Probably not, but some progress in both respects is likely to be made.

MARK JEFFERSON

Mapping Agricultural Production in South America

Lila Thompson. **Corn, Wheat, Sugar, Rice, and Cotton in South America.** Maps, ills. *Bull. Pan Amer. Union*, Vol. 52, 1921, pp. 339–363.

Lila Thompson. **Distribution of Live Stock in South America.** Maps, ills. *Bull. Pan Amer. Union*, Vol. 53, 1921, pp. 109–124.

The line of research which made Finch and Baker's "Geography of the World's Agriculture" so valuable a contribution to economic geography has been followed in these useful papers. The writer, research assistant in agricultural geography in the United States Department of Agriculture, has compiled available statistics showing the importance of the crops named and of the live stock (cattle, sheep, goats, swine) in each of the South American countries and has mapped their distribution.

These papers supplement the larger work referred to in that the production of many South American countries was proportionately too small to find a place in a summary of the regions most important in the world's agriculture. Production rather than acreage is made the basis of representation of the crops, because statistics of acreage devoted to individual crops are not published by most of the South American countries.

The production maps (scale 1 : 50,000,000) that accompany the articles, when compared with maps showing relief, rainfall, temperature, and the distribution of population, afford an excellent basis for study of various geographic factors that have affected human occupation in the several regions. Some of these factors are brought out in the papers: others will be readily apparent to the student of South American geography.

An Agricultural Atlas of Wales

J. Pryse Howell. **An Agricultural Atlas of Wales.** [6 and] 23 pp.; maps. Prepared for the Inst. for Research in Agricultural Economics, Univ. of Oxford. Ordnance Survey, Southampton, 1921. 5 s. 10½ x 15 inches.

This publication consists of 18 maps showing, by the dot system, the geographic distribution of the more important crops and kinds of live stock in Wales, by parishes, according to statistics collected by the Ministry of Agriculture and Fisheries in 1918. In addition, 5 dot maps show the distribution of market towns, of mountain and heath land, of permanent grassland, of arable land, and of bare fallow. An envelope at the back, furthermore, contains three colored maps showing the geology, the topography, and the average annual rainfall. The crop, livestock, and other distribution maps are printed on translucent oiled paper; and the colored maps, being loose, can be inserted beneath the dot maps in order to facilitate comparison between distribution of the crops and the physical conditions shown on these three maps.

The relationship between the rainfall and the distribution of wheat is clearly marked, most of the wheat being grown in those areas having less than 40 inches average annual precipitation, and practically none in areas having over 60 inches. This absence of wheat from the regions of heavy rainfall may also be due, in part, to the higher elevation and presumably cooler temperatures of these upland areas and to the rougher topography. However, as wheat in nearly all parts of the world is of greatest importance in regions having 15 to 35 inches of rainfall, it seems very likely that in Wales, also, the amount of precipitation is the primary factor in determining the distribution of this crop. Barley, on the other hand, shows the densest distribution in regions having 40 to 60 inches of rainfall, while a considerable acreage of oats is indicated for areas having over 80 inches of rainfall and appears to be densest in the 40 to 60 inch zone. Beans are practically confined to the regions having less than 30 inches of rainfall, while potatoes, turnips, and mangolds show no marked preference with reference to amount of annual rainfall.

The correlation of crop distribution with topography and altitude is also evident, the crops being grown in the valleys and on the lower slopes of the mountains, while the higher slopes are largely covered with heath and an appreciable acreage of permanent grass. The comparison of the map of arable land with the relief map is especially effective.

The inclusion of the geological map appears to be due to tradition rather than any correlation between the geological formations and the distribution of the crops. Indeed, the author in the introduction says, "It will be observed that except in the mountainous

areas the geological formation does not determine the distribution nor the density of either crops or livestock."

It is unfortunate that Great Britain has not awakened as yet to the value of a soil survey in directing the development of agriculture, as well as in affording an explanation of the geographic distribution of crops and systems of farming. Undoubtedly, if a soil map had been available it would have been substituted for this practically useless geological map.

The unique feature of this publication consists in printing the dot maps on oiled paper so as to permit comparison with the physical maps. This detracts somewhat from the visibility of the dot maps, but greatly enhances their value for study purposes. If it had been possible to print the physical maps instead of the dot maps on oiled paper, comparison would have been possible without this diminution of visibility.

The Atlas is of practically the same size and shape as the "Geography of the World's Agriculture," published by the U. S. Department of Agriculture; but why it should have been made of this shape is not so clear, as, unlike the United States, Wales is longer than it is broad, and even with the insert table not more than two-thirds of the page is occupied. These insert tables, showing for each county the acres of arable land and the acreage of the particular crop, also the percentage which this acreage bears to the arable land, are a valuable feature. Also deserving of special note is the fact that the dots are distributed by parishes, which roughly correspond in area with townships in the United States. Thus a more exact and detailed distribution is shown than is possible in the case of the United States, where statistics are tabulated by counties.

The introduction to this Atlas indicates that a corresponding publication for England may be available at an early date. This would constitute an even more notable addition to our knowledge of the agricultural geography of foreign countries; and if the work is carried out with the same detail and care that is shown in the Atlas of Wales, it will be of great value to students of agriculture and geography everywhere. It is hoped that this larger atlas may be published soon. If the author would comment on the physical and economic causes of the distribution of the crops and live stock more fully than has been done in the Atlas of Wales, it would materially enhance the value of the publication to those students in foreign countries particularly who have not had the opportunity to travel in England and, consequently, are not familiar with local conditions.

O. E. Baker

Man and His Past

M. C. Burkitt. **Prehistory: A Study of Early Cultures in Europe and the Mediterranean Basin.** With a short preface by l'Abbé H. Breuil. xix and 438 pp.; ills., bibliogr., index. The University Press, Cambridge, 1921. 9½ x 7 inches.

This new textbook on the prehistoric period appears at a most opportune time, just when interest in research is reviving after the long interruption occasioned by the late war. It will appeal primarily, of course, to workers in the archeological field. But it also contains much that will be of value to students of the history of art; while all those who feel the fascination of the story of primitive man, or who wish to keep in touch with the progress of discovery, will find "Prehistory" abundantly worth the reading.

It may be said by way of premise that Professor Burkitt's choice of a title for his book does injustice to a really excellent piece of work, simply because it awakens too great expectations. As a perusal of the volume will show, comparatively little attention is paid to any part of the Mediterranean Basin, or of Europe either, save southern France and northeastern Spain. Other areas are mentioned only rarely, and then as a rule merely for purposes of comparison or contrast. Further, instead of presenting us with the connected story of man's physical and cultural development during the whole of the prehistoric period, as the title would lead us to expect, the author confines himself almost wholly to the implements and the art of the Old Stone Age. Within these limits of time and space and subject matter, however, the book merits no little praise.

The opening chapter gives a brief but good account of the distribution of early man and the conditions under which he lived; the outline of the development of the science of prehistoric archeology (pp. 10–15) with which it terminates should be particularly useful for purposes of reference. A timely caution is given (p. 2) against confusing cultural and time ages—something that might be obviated if writers would speak of culture stages instead of ages. But Professor Burkitt is hardly justified in characterizing (p. 3) the absence

of a Bronze Age as "abnormal." If he had in mind the particular area indicated in the subtitle of his book he would be perfectly right; but he happens here to be speaking of Fiji. A Bronze Age is by no means a phenomenon of universal or even of general occurrence. It appeared only in a definite area of the Old World, as one of the elements of a particular culture complex. In point of fact by far the greater part of the world has gone directly from the Stone Age into that of Iron.

The second and third chapters deal with the geology of the early human period, while the fourth gives an interesting account of flint and its properties and the various types of implements made from that material. The descriptive classification of Paleolithic artifacts on pages 67–78 is full and explicit. The same mastery of the subject appears in the following eight chapters, treating of the successive culture divisions of the Old Stone Age. These are among the best in the book. The author's suggestion of an African origin for the Chellean culture (p. 86) is of particular interest in the light of the recent discovery in South Africa of a skull of Neanderthaloid type and of implements resembling those found at Chelles-sur-Marne.

Chapters XIII and XIV, dealing with the Neolithic and Bronze Ages and the physical characters of prehistoric man respectively, are brief and would be altogether inadequate were the book really, as its title suggests, a study of the whole prehistoric period.

But the last eight chapters, having to do with the absorbingly interesting subject of the art of primitive man, are again excellent. Chapters XV, on cave art, and XVI, on decorated objects—the so-called *art mobilier*—are especially good. The somewhat limited geographical distribution of the surviving examples of the cave art is well brought out; but, as the author says, it is only in limestone areas that suitable caves occur, so that there may have been painting of a similar sort elsewhere, done on wood or other perishable materials (p. 205). Bison skins, with which Paleolithic man was undoubtedly well supplied, will suggest themselves to those familiar with the American Indian custom of painting on "buffalo robes."

An unusually happy addition to a work of this character is the glossary (pp. xviii–xix), giving the English names of the various types of Paleolithic implements, with their equivalents in French, German, and Spanish. The bibliography is comprehensive, up-to-date, and conveniently arranged, particularly in reference to dates of publication. An equal measure of praise cannot, unfortunately, be given to the index, which is both incomplete and inaccurate. Eoliths, for example, are mentioned repeatedly in the text, and that by no means solely in the chapter devoted to them; yet they are not listed in the index. Again, two of the most important references to copper in the entire book (those on pp. 33 and 37) do not appear, while one that is given (that to p. 160) is wrong. Numerous other instances of the same sort of thing could readily be cited.

It would seem that a good deal of the matter appearing in the footnotes might have been incorporated in the text, while many of the lists and tabulations scattered through the book, valuable though these all are, could have been relegated to an appendix with a distinct gain in readableness.

The forty-seven plates at the back of the book are well chosen; but regard for the convenience of the reader would have suggested their being inserted in juxtaposition to the particular portions of the subject matter which they are designed to illustrate.

By far the most serious defect in the book is the total absence of maps. There are literally scores of instances where even a sketch map in the text would have helped amazingly in showing the distribution of this or that race or culture element; and this is intended as no reflection upon Professor Burkitt's textual presentation of his subject, which is both clear and well ordered. Especially valuable would have been a map giving the geographical boundaries of the successive stages of the Upper Paleolithic; in no other way could the relationship of the peculiar and anomalous Solutrean to the preceding Aurignacian and the subsequent Magdalenian cultures have been so clearly brought out.

These drawbacks notwithstanding—and only the last-named is really serious—"Prehistory" forms a valuable addition to the literature in English dealing with the culture of the Old Stone Age. It should do much to stimulate interest in a line of research whose activities, thus far confined largely to western Europe, it is to be hoped will speedily be extended to embrace other portions of the globe that have been hitherto relatively neglected. For not in Europe, we may be assured, will be found the answer to the problem of man's origin.

C. W. Bishop

J. M. TYLER. **The New Stone Age in Northern Europe.** xviii and 310 pp.; map, ills., bibliogr., index. Chas. Scribner's Sons, New York, 1921. $3.00. 8 x 6 inches.

So much attention has been drawn of recent years to the Old Stone Age with its numerous and fascinating problems and its slowly unfolding picture of the life of its cave men and its mammoth hunters, that the succeeding period of the Neolithic has undeniably been slighted. Yet the significance of the latter to any reasoned study of the progress of the human race can hardly be overemphasized, for then it was that first appeared the germs of nearly all the basic elements of our own civilization. For this reason, as well as for its own manifold merits, Professor Tyler's book deserves a hearty welcome.

The text is divided into twelve chapters, of somewhat unequal merit. In the first, "The Coming of Man," the various stages of human evolution, physical and cultural, so far as we yet know them, previous to the commencement of the Neolithic, are well presented, although the enormous duration of this earliest period as compared with the succeeding ones might have been indicated with greater emphasis. More, too, might well have been said of the fundamental importance of the line of demarcation between the Lower and Upper divisions of the Old Stone Age. For it was then that the lowly race known as that of Neanderthal, which had so long inhabited Europe, was replaced by that of *Homo sapiens*, to which all existing races belong. Judged from this point of view, the break which occurred between the Mousterian and the Aurignacian subdivisions of the Paleolithic is of vastly greater import than anything that has taken place since in the entire history of man. Yet it is dismissed (p. 30) with less than four lines.

The influence of the former dense forest growth upon the spread of peoples and cultures over the face of Europe previous to the introduction of metal is well brought out in the third chapter, while the fifth, entitled "A Glance Eastward," contains an excellent account of discoveries in western Asia that tend to throw light upon the origins of different elements of Neolithic culture subsequently appearing in Europe. The importance of the widespread trade of prehistoric times receives due notice also, and the influence of geographical factors upon racial distribution and culture diffusion is well analyzed. This chapter is decidedly among the best in the book.

Not quite so much can be said of the following one, dealing with the question of megalithic monuments. It is perhaps hardly fair to criticize a book dealing with northern Europe because it fails to mention phenomena appearing in other regions. Still, since Professor Tyler himself mentions the existence of these constructions as far afield as India (p. 117), it is hard to see why he ignores their occurrence throughout the Indonesian and Oceanic areas, as well as in Japan, where they are so important that the protohistoric period there actually goes by the name of the Dolmen Period. Furthermore, the latest book dealing with this subject that is mentioned in the bibliography bears date of 1913, although very many of the most important investigations in this connection have been carried out since that year. The recent work of G. Elliot Smith and W. J. Perry, in particular, ought by no means to be passed over, even though one may not be prepared to accept all their conclusions.

The twelfth and longest chapter, devoted to "The Coming of the Indo-Europeans," is again one of the best in the book, but the subject is far too large a one to admit of a detailed discussion here.

A general criticism of the work might be that insufficient emphasis is placed upon the strictly communal character of the institutional and economic life of the Neolithic period, although it is true that this is touched upon to a certain extent (e.g. on pp. 275, 276). The "genuine farms" ascribed (p. 131) to the loess regions and the Danube valley, for instance, are likely to suggest to the lay reader the type of rural economy existing today in the British Isles, or in the United States, rather than the rigidly organized village community system, with its suppression of the individual in favor of the group, which actually prevailed.

The bibliography is avowedly incomplete, as indeed could hardly be otherwise. So far as it goes, it is extremely well chosen. It seems strange, however, that a book bearing date of 1921 should contain so few references to works published since 1914. The periodical literature of recent years also deserves more notice than it receives. The index, of only two scant pages, is quite inadequate to a book of this sort. A larger number of maps would seem to have been an improvement. In the one which does appear (facing p. 184), the likelihood of early human migrations from Asia to Africa having occurred right across

Arabia, or around the southern coast of that peninsula, is not indicated, while by some curious mischance the Syr Darya—the classical Jaxartes—is dubbed the Amur.

It may safely be said that "The New Stone Age in Northern Europe" forms a real addition to the literature in English bearing upon the Neolithic Period. Although not an original contribution to knowledge in the sense that it presents facts not hitherto published, it will undoubtedly prove extremely useful for the connected and well-drawn picture it gives of the period to which it is devoted. The author's style is notably attractive and readable. His book will well repay perusal, not only by professed students of the past, but by the public at large.

C. W. BISHOP

O. G. S. CRAWFORD. **Man and His Past.** xiv and 227 pp.; maps, ills. Oxford University Press, London, New York, Toronto, Melbourne, 1921. $4.75. 9 x 6 inches.

Mr. Crawford's book is an illustration of the growing feeling for the unity of knowledge that has of late found expression among a number of the students of man. It is the expression of the devout archeologist who sees in the ordered labors of his chosen work that "one stone the more swings into place" in the temple of knowledge; and who, furthermore, sees it in place in the structure as a whole. Thus the main portion of the book is occupied with discussion of the meaning of archeology and its relation to history, anthropology, and geography. Geography is the space aspect and as such the essential background for the study of any time aspect. It follows that emphasis is laid on the *changing* environment, and a word of caution is given to those who stress environment to the exclusion of all else. "Environment by itself can create nothing when the soil is unprepared. That is the explanation of so many geographical problems." History finds new interpretation and method with recognition of the space factor. Consider for instance the new orientation given to study of the later Middle Ages viewed as the culminating stage of a process of forest clearing that began in prehistoric times. And what is true for history is no less true for prehistory.

Portrayal of the geographical aspect raises the demand for maps, "as important to our knowledge of man's past states as are maps of the world today to the soldier or the economist, or even the politician, if he could but realize it." Not only does the archeologist seek the broad background to his detailed studies in environmental maps—an Atlas of Environment is called for—he must himself use the geographical method in prosecuting his researches. Distributions are as important as the objects distributed. Thus are determined the sites of ancient settlements, of trade routes, and movements of peoples (see Mr. Crawford's paper "Prehistoric Geography" elsewhere in this *Review*); and "the growing map is the source of all inspiration."

"Man and His Past" is concerned with no detail, it discusses no special region or period, save for the illustration of archeological method given in the chapter entitled "Roman Roads," from the author's immediate field of work. It is a view from the hilltops, a heartening and courageous view.

H. J. FLEURE. **Geographical Factors.** 31 pp.; bibliogr. (Helps for Students of History, No. 44.) Society for Promoting Christian Knowledge, London, 1921. 6d. 7 x 5 inches.

The thesis of Dr. Fleure's booklet is essentially similar to that of Mr. Crawford's "Man and His Past" (see above)—the fundamental fact of the unbroken continuity of human experience. The study of human experience involves the elements of "time" (history), "type" (anthropology), and "place" (geography). The danger of giving undue weight to one factor is illustrated by the view of environment as a control of human action in the narrow, determinist sense. For instance "without sufficient reference to the general world setting and the working of inherited momentum, it is but too easy to go astray and to 'explain' the Vikings of the fjords of Norway as the product of their environment without realizing the limitation of such views due to the fact that the Vikings are also characteristic products of a certain period."

The making of history has its correlative in the altering of environment; hence the need of maps of past as well as present conditions, maps requiring the co-operation of workers in several fields—historians and anthropologists and geographers. There is also the forward outlook, the changing environment of the future, a study that makes heavy demands now that "the effective environment" of each one of us is "nearly the whole world."

A Popular Presentation of Polar Phenomena

Otto Nordenskjöld. **Polarnaturen.** xii and 143 pp.; maps, diagrs., ills., bibliogr. (Populärt vetenskapliga föreläsningar vid Göteborgs Högskola, Ny följd, No. 15.) Albert Bonniers, Stockholm, 1918. 4.75 kroner. 7½ x 5 inches.

In "Polarnaturen" Otto Nordenskjöld presents in a popular way, and in language that the layman finds intelligible and interesting, the phenomena of the polar worlds, both south and north, a task for which he is well fitted by his travels and studies.

The first chapter is devoted to the discussion of polar climates; their influence as geographic factors; the three types of polar climate—land type, sea type, and ice type—and their distribution; and a résumé of the subject. This is followed by a chapter on ice in polar lands, its occurrence, its origin, its distribution in various types and their significance, and ice-free districts in the polar region. In the third chapter the author discusses characteristic aspects of polar landscapes; the peculiar and widespread phenomena of solifluction and *polygonboden;* the character of polar flora and fauna and their ecology; and the evolution of life forms in polar lands. An attempt is made in the fourth chapter to define the limits of true polar and subpolar lands, and to divide them into natural provinces and belts, based upon climate, vegetation, and animal life, and such other natural phenomena as lend themselves to the purpose. The high arctic regions about the North Pole are given particular attention.

The cause of the glacial period and the phenomena connected with it in the light of present ice distribution and related phenomena constitute the subject matter of the sixth chapter, probably the most fascinating part of the book, while a final chapter is devoted to the effect of the glaciers upon the topography and landscape of Scandinavia, with considerable attention to such physiographic forms as fiords, terraces, cirques, strand plateaus, and hanging valleys.

In a peculiarly pleasing conclusion summarizing the characteristic phenomena of polar lands the author emphasizes the climate, the ice mantle, and the sparse vegetation as being the distinctive features of polar nature, and points out the significant and difficult problems still confronting the polar explorer.

W. Elmer Ekblaw

The Development of Geography in the Nineteenth Century

Otto Nordenskjöld. **Geografisk Forskning og geografiske Opdagelser i det nittende Aarhundrede.** (Series: Det nittende Aarhundrede skildret af nordiske Videnskabsmænd, No. 19.) 159 pp.; maps, ills., diagr. Gyldendalske Boghandel, Nordisk Forlag, Copenhagen, 1920. 10 x 6¾ inches.

Otto Nordenskjöld here gives a short treatment of the origin of modern geography at the beginning of the nineteenth century, its development up to the present time, and the exploration and colonization of the different parts of the globe. About half the book is devoted to the history of exploration. In one chapter the author deals with the mainsprings of such movement—economic gain, political conditions, scientific interests, etc. Under the head of scientific knowledge of the surface of the earth he treats of the mapping of the globe, division of the land, formation of the continents, origin of the types of landscape, structure and origin of mountains and rivers, formation of valleys, work of the ice, coasts, deserts, loess, coral islands, etc. Another chapter is devoted to climate, plants, and animals, with maps showing the distribution of temperature, atmospheric pressure, cyclones, precipitation, types of climate, phytogeography, and its development—zoögeography. Finally anthropology, ethnography, and anthropogeography are shortly touched upon.

E. Antevs

A Visit to Crusoe Land

Carl Skottsberg. **Till Robinson-Ön och Världens Ände.** 208 pp.; maps, ills. Albert Bonniers, Stockholm, 1918. 15 kroner. 9½ x 6½ inches.

Robinson Crusoe's own book is hardly less entertaining than this interesting narrative of an explorer's visit to the Juan Fernandez group and Easter Island.

Financed by various societies and institutions of Sweden, the "Swedish Pacific Expedi-

tion" of 1916 and 1917 set for itself the task of studying the natural history of these islands and collecting as much museum and scientific material as possible. It was eminently successful in its object and repaid manyfold the time and money spent.

The route of the expedition lay by Christiania, Kirkwall, Panama, the western coast of South America to Chile, and finally to Juan Fernandez and Easter Island. Mas-a-tierra, the larger of the Juan Fernandez group, with Santa Clara, a tiny islet at its southern extremity, occupied most of the explorer's time. This mountainous island, with scarcely enough beach to afford adequate landing place, is about thirteen miles in length and four in width. Clothed in the most luxuriant vegetation, the mountains are difficult of traverse; but by determined effort the explorer sought out every nook and corner, wherever he might obtain anything of interest. The physiography, climate, plant and animal life all receive attention, but throughout his work the explorer does not lose sight of the human element; the culture and industries of the limited population are not neglected.

After completing his work on Mas-a-tierra and Santa Clara, the explorer visited Mas-afuera and gave it almost as careful attention as he did the larger island. Mas-afuera is even more mountainous than Mas-a-tierra, and high cliffs form its entire coast line. Every bit of research on this rugged lonely island demanded full toll of the explorer's strength and endurance, but he apparently enjoyed every moment. The visit to Easter Island was more cursory. A short note on the observations made here was published in the *Geographical Review*, Vol. 11, 1921, p. 448.

With a final chapter on Chile and a brief conclusion the book ends. Contour maps of Mas-a-tierra and Mas-afuera enhance the value of this excellent work.

W. Elmer Ekblaw

A Textbook of Agricultural Meteorology

J. Warren Smith. **Agricultural Meteorology: The Effect of Weather on Crops**. xxiv and 304 pp.; maps, diagrs., ills., bibliogr., index. (Rural Text-Book Ser., L. H. Bailey, edit.) The Macmillan Co., New York, 1920. $2.40. 7½ x 5 inches.

This first American textbook on agricultural meteorology, by the foremost American authority on this subject, should not pass unnoticed or unused by geographers. At the outset Professor Smith presents in highly condensed form an illustrated exposition of elementary meteorology. Then follow chapters on agricultural meteorology and climatology. Methods of correlation are treated in detail as an introduction to the discussions of climate and crops, climate and farm operations, and weather and crops. The subject of the effects of weather on the various crops constitutes the bulk of the book; fiber crops, fruits, grains, and miscellaneous crops are considered in groups and individually. The closing chapters deal with weather forecasts and warnings, frost and frost damage, and the value of lightning rods.

As the author took great pains to get criticisms and advice from meteorologists and agriculturists the book is gratifyingly free of errors. Professor Smith was a teacher of agricultural meteorology for many years, and the book is well fitted for instruction. Paragraphs are short; illustrations well chosen, abundant, and mostly up-to-date (Fig. 73 is a glaring exception); and the scale and printing of the diagrams very satisfactory. At the end of each chapter are numerous suggestions for laboratory exercises and an extensive bibliography. Unfortunately for the teacher and more advanced student there are no references in the text to the particular publications in the bibliography. In all respects the book is easy to read and consult. It is eminently practical for the farmer, a useful reference book for the geographer, and a very interesting work for any reader.

Charles F. Brooks

A Geographical Compendium of the Provinces of Spain

Benito Chias y Carbó. **Cartas corograficas.** 1296 pp.; maps, ills. (España Regional: Descripción Geográfica.) Alberto Martin, Barcelona, n.d.

Illustrative of the tendency toward intensive regional study of geography in Europe as in America is the work published under the above title. It was issued periodically and now comprises 120 *cuadernos*, as each section is styled. The work is regional ("chorographic" as the Spaniards say) in that it treats different districts separately. The "regions," however, are not purely geographic units, but rather political and historical, being the ancient kingdoms of Spain in the creation of which geography figured as one, but only one, of the

factors. These regions are distinguished neither by physiographic nor economic unity. Though more nearly resembling geographic regions than the present arbitrarily determined "provinces," they conform neither to the configuration of the land, the character of the soil, the differences in climate, nor to the human relations which arise from interchange of earth products. They were the result, in part, it is true, of the value of mountain barriers which divided the peninsula into easily defended petty kingdoms. But in modern times these natural features have largely lost their meaning as military assets and have taken on a new significance in the development of an agricultural and industrial nation. Hence the title is, perhaps, somewhat misleading.

The work is not modern, moreover, in its treatment, being almost entirely descriptive. Encyclopedic would very nearly describe its general character. In fact, so detailed is the description that it might almost be termed "topographic" in the British sense of the word.

There is an occasional reference to influence of soil, climate, and topography upon the character and distribution of vegetation or animal life, but little effort is made to show human relations to the land. Agriculture, industry, commerce, navigation, though described in detail, are not shown in their relation to geographic controls. The same may be said regarding the distribution of the people.

The maps accompanying the periodical issues of "España Regional" are of two kinds: plans of different cities in Spain and maps of the existing "provinces." The latter are of varying scale and are based on data supplied by the Instituto Geográfico y Estadístico. The information furnished by these maps is both full and up-to-date. Railroads, roads, canals, and telegraph stations are marked, as are also distances between road junctions and exact elevations so far as ascertained by the topographical surveys.

On the reverse side of every sheet are printed such data as lists of the wards in each city, elevation of points determined and the geographical co-ordinates ascertained by geodetic surveys. For the seaports lights, landmarks, etc., are shown.

Holland's Importance as a Horticultural Land

H. Blink. **Nederland als Tuinbouwland: Historisch en Economisch-Geographisch Beschreven.** Suppl. to *Tijdschr. voor Econ. Geogr.*, 1916, pp. 229–362. Maps, diagrs., ills. Mouton & Co., The Hague. 3 florins. 11 ½ x 9 inches.

To most Americans Holland is well known as a land of bulbs and flowers, but few there are who realize the extent to which all forms of garden and orchard culture have possessed Holland in the last half-century. In this volume, copiously illustrated with maps and photographs, Dr. Blink presents forcibly the eminent position that Holland holds among the gardening peoples of the world—in vegetable growing, in fruit culture, in bulb growing, and in seed production. He traces the history of the rise of horticulture in Holland, from a few first gardens kept by royalty to the present high stage of the art with over 13,000 florists, 3,500 bulb growers, 24,000 truck growers, and 6,000 tree culturists—a total of over 45,000 horticulturists within its narrow borders. In 1913 the horticultural societies of Holland numbered 294 with a membership of over 34,000. The extent of the industry is further illustrated by the fact that, in 1912, 4,768,300 square meters were under glass.

Perhaps nowhere in the world are so many kinds of vegetables raised and exported. Throughout the length and breadth of Holland, but more particularly near the coast, the land is dotted with vegetable gardens, where thousands of men, women, and children work industriously throughout the summer season. The phosphate beds of Florida and Algeria, the nitrate fields of Chile, and the potash deposits of Germany have all contributed to these garden spots of the Dutch. And then the gardeners send forth their fine fresh and dried and canned products to the far corners of the earth. (The reviewer of this article has eaten Dutch dried soups in northern Greenland.)

The culture of fruits and berries is scarcely second to olericulture. Every province of Holland grows great quantities of fruit, mostly inland. And here again the reader is astounded at the magnitude of the industry. Hundreds of thousands of square meters under glass—grapes, strawberries, peaches, apricots, and other fruits by the hundreds of tons. In 1913 Holland sent to England alone 28,512 hundredweight of apples; 66,006 of pears; 30,291 of cherries; 50,415 of currants; 4,396 of gooseberries, besides many hundredweight of other fruits and of nuts. And this was but a fraction of the export trade.

Even in tree and shrub culture the Dutch are unexcelled. Thousands of acres are given

over to the growing of shrubs and trees—coniferous, deciduous, fruit, nut, and shade trees; rhododendrons, azaleas, magnolias, clematis, roses, lilacs, palms, syringas, and hundreds of other species come under cultivation. In 1913 the foreign trade in trees and shrubs aggregated 43,192,577 pieces.

For two centuries at least the Netherlands have been known the world over for their bulb culture. As early as the fifteenth century the Dutch began introducing bulbs and other plants from foreign lands. Dutch maritime activity sent the ships of Holland to every land and port; lovers of flowers always, the Dutch sailors and adventurers brought back with them to their native land the most beautiful plants and flowers wherever they found them. The iris and the tulip were early introductions, and of the latter flower the Dutch became so infatuated that a veritable craze swept over the country in the seventeenth century. Over 140 varieties of tulips were grown at that time, and rare bulbs sold at fabulous prices. Following the tulip, the hyacinth, became popular. From its native home in Dalmatia, Greece, and Asia Minor, the hyacinth, after its introduction in Holland, soon spread throughout western Europe. It was in Holland that the large and beautiful varieties were developed, and the culture of both tulips and hyacinths was placed on a scientific basis. About the middle of the nineteenth century Dutch growers began exporting bulbs of all kinds in quantity. It was at this time that bulb culture and bulb trade assumed an important position in Holland's industries, a position which has constantly been strengthened, until in 1914 this industry ranked near the top among the productive and remunerative activities of the Dutch people. Most of the large bulb gardens lie along the coast. Here gardens of hundreds of acres are not rare, and in blossom time the coastal provinces become veritable gardens of the gods. In 1915 nearly 27,000,000 kilograms of bulbs were exported, of which 8,000,000 were shipped to America and 8,000,000 to Great Britain. Germany and Austria imported 4,000,000, Scandinavia 4,000,000, and the remainder were distributed to almost every land in the world.

Finally, Holland holds a prominent place in the growing of garden seeds, both vegetable and flower, though it is in the plants of the *Cruciferae*—radish, cabbage and its near relatives, turnip, and cauliflower,—spinach, beets, and beans, that most of the quantity is produced and most of the value received. Statistics indicate that in 1913 the Dutch seed gardens produced 2,000,000 kilograms of garden seeds, valued at 1,000,000 gulden.

The government and the many horticultural societies are carefully safeguarding the horticultural industries and trade. The best scientific knowledge and equipment are procured; well-planned publicity and propaganda are put out; the gardeners are given every opportunity for training and development; and cordial relations are maintained with every bulb-importing country. A determined effort is being made to stamp out every pest, every plant disease that may lead to embargoes or restrictions against Dutch products.

Holland is not likely soon to yield its dominance in horticulture to any other land. Favorable natural conditions, an industrious and frugal folk, and an intelligent government insure long years of supremacy.

W. Elmer Ekblaw

A Brief Geographical Study of Denmark

H. P. Steensby. **Danmarks Natur.** Extract (Vol. 1, pp. 1–36) from "Danmark: Land og Folk: Historisk-Topografisk-Statistisk Haandbog," edited by Daniel Bruun. Vols. 1, 2, 3, 5. Gyldendalske Boghandel, Nordisk Forlag, Copenhagen and Christiania, 1919–21. 9½ x 6 inches.

This compact study by the late Professor Steensby condenses a wealth of geographic information regarding Denmark, valuable to every student of geography.

The extent of the country and its dependencies, its relative size and importance, its semi-insular character, its low relief, its many waterways, its history, its colonization projects, its ambitions constitute the first division of the book. Then follow in succession, brief, richly informative chapters on "The Danish Seas," with a review of Denmark's sea history and its sea influence; the "Extent and Population" of the land by provinces and sections, a valuable comparative study; "Terrain and Maps," a chapter which includes within brief compass the topography, the geology and the soil, and an account of the more important maps of the country from the earliest to the latest.

W. Elmer Ekblaw

Erosion in the Driftless Area

A. C. Trowbridge. **The Erosional History of the Driftless Area.** 127 pp.; maps, diagrs., ills. *Univ. of Iowa Studies in Nat. Hist.*, Vol. 9, 1921, No. 3 (1st Ser. No. 40). University of Iowa, 1921. 9½ x 6½ inches.

The Driftless Area of southwestern Wisconsin, extending into adjacent portions of Minnesota, Iowa, and Illinois, is a field of absorbing interest to the student of earth sculpture, for here is a region, well within the drift-covered district of the United States, in which the products of normal subaerial erosion have been preserved intact. Since the early and well-known description of the area by Chamberlin and Salisbury a considerable number of articles have been devoted to certain parts of it, but few have taken up the erosional history of the district as a whole. Professor Trowbridge has studied many parts of the area, has been at work in it at intervals during a number of years, and is thus well qualified to speak of it as a whole.

His report is divided into two approximately equal parts, the first of which is entitled "Multiple Erosional Cycles in Principle." Here he gives an analysis and discussion of the evidences to be looked for which will indicate that a given district has undergone more than one cycle of erosion. These evidences are interrupted profiles of valleys, stream terraces, intrenched meanders, associated sets of straight and crooked streams, antecedent streams, wind gaps, even-crested summit areas, intermediate plains, and fluviatile deposits on uplands. Each of these evidences is analyzed in some detail, and the conclusion is reached that no one of the lines of evidence can be relied upon as absolute proof of more than one cycle of erosion, but that some lines of evidence are more convincing than others. In any particular area the combination of two or more of these lines of evidence should be relied upon to prove more than one cycle of erosion; and the more combinations, the more clear the proof.

The application of the above analysis to the Driftless Area shows that in that area the following evidences point to more than one cycle of erosion: Even-crested summit areas, intermediate plains, antecedent streams, entrenched meanders, associated sets of crooked and straight streams, stream terraces, and upland fluvial deposits. A feature of the Driftless Area is the presence of even-crested summit districts which mark a peneplain here designated as the Dodgeville plain. Above this plain rise a few erosion remnants. The Dodgeville plain slopes S. 23° E. at a rate of 3.3 feet per mile and is thus not in accordance with the nearly flat strata of the district, which have an average dip of 14.2 feet per mile towards S. 28° W. This plain bevels across, though at a very low angle, strata from the Niagara down to Prairie du Chien (Lower Magnesian), and the author considers the flat tops of the Baraboo quartzite ridges to belong to this same erosional surface. Lying about 200 feet below this plain is another, the Lancaster plain. This is the most prominent feature of the district and has, in the author's opinion, been confused with the higher plain. Into the Lancaster plain, which slopes 7.6 feet per mile towards S. 11° E., have been cut the valleys of the region, and some of their larger streams have markedly intrenched meanders.

The erosional history of the Driftless Area includes the formation of the extensive Dodgeville plain which the author considers to have been completed in Tertiary time—in late, rather than early or middle Tertiary time. This was followed by a slight uplift and the development of the Lancaster plain, which is of late Tertiary or possibly early Pleistocene age, for there is some evidence that this plain had not been dissected at the time of the deposition of the Pre-Kansan drift. Then an uplift of about 600 feet occurred, followed by the development of the present topography of early maturity. About the time of the Wisconsin drift the district was depressed approximately 180 feet.

An interesting feature of the paper is the explanation of the history of the Mississippi River between Minneapolis and Dubuque and the suggestion of this river's antecedent character.

U. S. Grant